THE LAZY COLON

NEWER METHODS AND LATEST ADVANCES OF SCIENCE IN THE TREATMENT OF CONSTIPATION

BY

CHARLES M. CAMPBELL

ASSOCIATED WITH

ALBERT K. DETWILLER, M. D.

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WHY THIS BOOK?

This book is believed to be unique, in fact the first of its kind in medical literature.

To understand this one must have some appreciation of the general character of the great masses of medical books that crowd the shelves of ever-growing medical libraries at home and abroad. Practically all these books are by physicians for physicians and it is almost impossible to find one written down to the comprehension of even the intelligent layman, who cannot understand the medical terms used, many of which are long Greek or Latin derivatives. If the reader stops to consider why this is so, the conclusion will probably be reached that the language of science is frequently not comprehended by the non-scientific, and further that the doctor who makes his living treating diseases can hardly be expected to possibly lessen the value of his services and the dignity of his position by baring his knowledge and its mysteries to his patients.

Of so-called non-professional health books there is apparently no end. They have been rather severely characterized as a weariness of the flesh, frequently written by incompetent people, often for the purpose of exploiting pet theories. So far as we are aware this is the first time an attempt is made to exploit not the theories of a writer but the mature investigations, discoveries and opinions of the most competent investigators and instructors in the medical and scientific world on this subject, each of whom has done something worth while. To go over a broad field of medical research and carefully select the best, which is generally also the latest, reproduce it in understandable, summarized form as a connected narrative, carefully developing the point in each case, so the lay reader can get an adequate compre-

hension of it, introducing the opinion of the present authors only where it will be helpful, is a task for a medical editor and is the one undertaken in this book.

The medical man has another peculiarity. Although this volume concerns itself in a large measure with one of the gravest physical disorders of civilized man, one that has been truly called "the mother of diseases," we are informed by so eminent an authority as Sir Arbuthnot Lane, probably the leading English abdominal surgeon, that the average physician considers the subject unworthy of special study until pain or some form of acute disease intervenes, when the books teem with discussions of the proper medical or surgical treatment. The fundamental delusion here of the medical profession, says the report of the president of the Rockefeller Foundation (1921) is that it makes a living from diseases, while the real scientific approach to the problem of human welfare is through their prevention.

The important truth underlying the present book is the recognition of the fact that "intestinal stasis, in one form or another (constipation), afflicts three fourths of the American people whether we want to believe it or not," and is the greatest single physical ill that besets the modern civilized, highly specialized, artificial human existence.* It is not classed as a disease or even mentioned in many medical books where the untrained reader expects to find it. Instead of being so listed by the great majority of writers it is mentioned as a condition only. But that fact does not lessen in the slightest degree the very great importance of derangements of the delicately-adjusted intestinal functions as causes of disease. There is no truth connected with the treatment of illness more generally recognized by medical authority than the dictum to "cure disease remove the cause." Everybody recognizes this truth when it is dragged forth. The amazing thing is that so many people prefer to temporarily relieve a condition rather than to seek the cause.

* In fact Foges of Vienna, specialist of the Rudolfinerhaus Hospital Clinic, says 90 per cent of women above the age of 25 are so afflicted. In a personal communication, Kellogg, of Battle Creek, thinks this a conservative estimate.

There is a widespread, almost universal need, for a plain, simple, authoritative discussion of this great subject, full of minute detail, so the wayfaring man cannot go wrong, all from the best sources, duly acknowledged in each case, reinforced by footnotes giving biographical data to show who the authority really is and the credence to which he is entitled, with the latest methods successfully adopted in fighting this scourge, and all for a less cost than for one visit of the family physician.

Such a book could not have been written so late as ten years ago. Some of the most valuable information it contains is not yet two years old. Back of 1907, when x-rays were first used in studying intestinal phenomena, there was little reliable information of many of the functions of the colon. One authority says that up to that time the human intestine was a sort of terra incognita—an unexplored internal organ over four and a half times the length of a six-foot man. Even now there are few competent men who have specialized on this subject. Before an investigator can qualify as an expert many hundreds, even thousands of cases, should pass through his hands and receive the most enlightened study. Relatively few men have had such opportunities and of these a large percentage are also interested in many other diseases that require critical examination.

The professional medical man of large and successful experience would never undertake a work of this character. It requires an editorial survey along medical lines wholly foreign to his methods. He is not primarily an expositor of other men's writings but a setter forth of his own experiences, discoveries and theories; in other words, he is distinctly a contributor to the general fund of medical knowledge.*

An interesting fact that developed from the study of this subject, that has now extended for a period of over twenty years, is that obsolete and worthless advice is still repeated by authors of good repute. Take cannonball massage as an instance. In at least two reputable books printed as late as 1921 the old advice is repeated

* My long experience as a publisher has taught me that intermediaries are needed between expert and lay readers.—*Henry Holt.*

to roll a covered cannon ball of twelve pounds, or greater weight (one author suggests twenty-five pounds), over the course of the colon as a means of massage in intestinal stasis. In the first place, unless the experimenter is exceptionally well informed, the location of the transverse colon is not known, as it is a common experience to find it looped well down in the abdomen, sometimes reaching the pelvic floor. In any event the cannon ball would do no more than increase the impaction of the contents, thus adding to the affliction from which the discouraged patient is already suffering.

Throughout the book no medical term that lies beyond the common knowledge is used without an accompanying definition so it can be easily understood by lay readers. These definitions are sometimes repeated at intervals but in different terms, on the theory that even intelligent readers are not likely to remember so many definitions of unfamiliar words. The reader who does not need them will keep in mind the large percentage of those who do and the paramount importance of reaching their understanding.

Nothing is of more importance in the study of this subject than a working knowledge of the anatomy of the organs involved. Adequate cuts from the best sources have been inserted in the text wherever they are useful so that the reader can follow it with real enlightenment.

The inference should not be drawn that there are no original observations in the text. Aside from the theory of the book, its scope and the orderly development of the theme there are certain views that, being new, were not derivable from any authoritative source. That the reader may not be misled the more important of them are set out: The superiority of bran to agar and the greater disintegrative power of the former as well as its power to retain much-needed moisture; the non-injurious effects of the wise use of the enema and its differentiation from the coliclyster (colon irrigation), with some basis in authority; the seriousness of the menace of incomplete defecation; harmonizing views on conflicting theories of water drinking; the chapter addressed to youth; a re-statement and extension of the theory of

abdominal exercises in comparison with massage; the very great importance of new discoveries in the use of lactose (sugar of milk) and the development and assembling of important facts that, outside the field of disease and frequently within it, indicate the principal cause of bad complexions, bad teeth and loss of hair.

Lastly, the primary motive behind the work is service; and the earnest hope of the authors is that they may be justified in their labors.

THE ART OF LONG LIFE

Health is that state of mind in which the body is not consciously present to us; the state in which work is easy and duty not too great a trial; the state in which it is a joy to see, to think, to feel, to be.—Sir Andrew Clark.

Only by prolonged and arduous efforts has any considerable element of the public been educated to identify the early symptoms of serious organic disease.—E. S. Cowles, M.D. (*Address*).

No one will be likely to dispute the statement that most people are unwell.—Dr. E. V. McCollum. (*Johns Hopkins, Newer Knowledge of Nutrition.*)

Men who would blush over an imputation of ignorance respecting the fabled labors of a fabled demi-god, show not the slightest shame in confessing that they do not know where the Eustachian tubes are or what is the normal rate of pulsation.—Herbert Spencer, in "*Education.*"

Ninety-five per cent of the deaths of mankind are from preventable diseases.—Marion Sims, M.D. (*Autobiography*).

The therapeutics of old age is a relative phrase, as many are physiologically older at 50 than others at 80.—A. Jacobi (*Yale Review*).

In searching for the obscure do not overlook the obvious. For one mistake made in not knowing ten are made by not looking.—Lindsay's Medical Axioms.

My attention has been frequently called to the frequency of arterio-sclerosis (impairment of the arteries) in persons who have been temperate in every respect except at table.—Sir William Osler, Oxford University, formerly of Johns Hopkins.

The science of medicine has made greater advance in the last twenty years than in twenty centuries. The boy of today has twelve more years coming to him than his grandfather could expect at the same age. And death could be delayed five years more if every man and woman would undergo a rigid examination by a competent physician at the age of 47 and carefully abide by the directions of his medical advisor.—Wm. J. Mayo, *distinguished surgeon (digested).*

One of the many marvels of the human body is the slowness with which Nature yields her defences against disease. The contest is generally a matter of years. In the long struggle to protect her own she would win the battle in a large percentage of cases if but slight assistance were given by the unintelligent sinner against the laws of health.—Charles M. Campbell.

Abstinence is one of the best of all remedies and alone cures without danger.—Celsus.

Consider how greatly ill health hinders the discharge of all duties—makes business often impossible and always more difficult; produces an irritability fatal to the right management of children; puts the functions of citizenship out of the question; and makes amusements a bore. Is it not clear that the physical sins which produce this ill-health make life a failure and a burden instead of a benefaction and a pleasure? In all cases a permanent damage is done; and, along with other such items which Nature in her strict account-keeping never drops, will tell against us to the shortening of our days. And if we call to mind how far the average duration of life falls below the possible duration, we see how immense is the loss. When to the numerous partial deductions which bad health entails, we add this great final deduction, it results that ordinarily more than one half of life is thrown away.—Herbert Spencer, in *"Education."*

While civilization has cost us dearly by increasing predisposing causes of disease, it is equally true that the same civilization has provided aids in prevention of disease that annually save many thousands of lives.—Hobart Amory Hare, M.D., in *New and Altered Forms of Disease.*

Constipation is a disease of civilization. Wild men and wild animals do not suffer from this malady, which is perhaps responsible for more human misery and mental and moral disaster than any other single cause.—John Harvey Kellogg, M.D., Battle Creek, Mich.

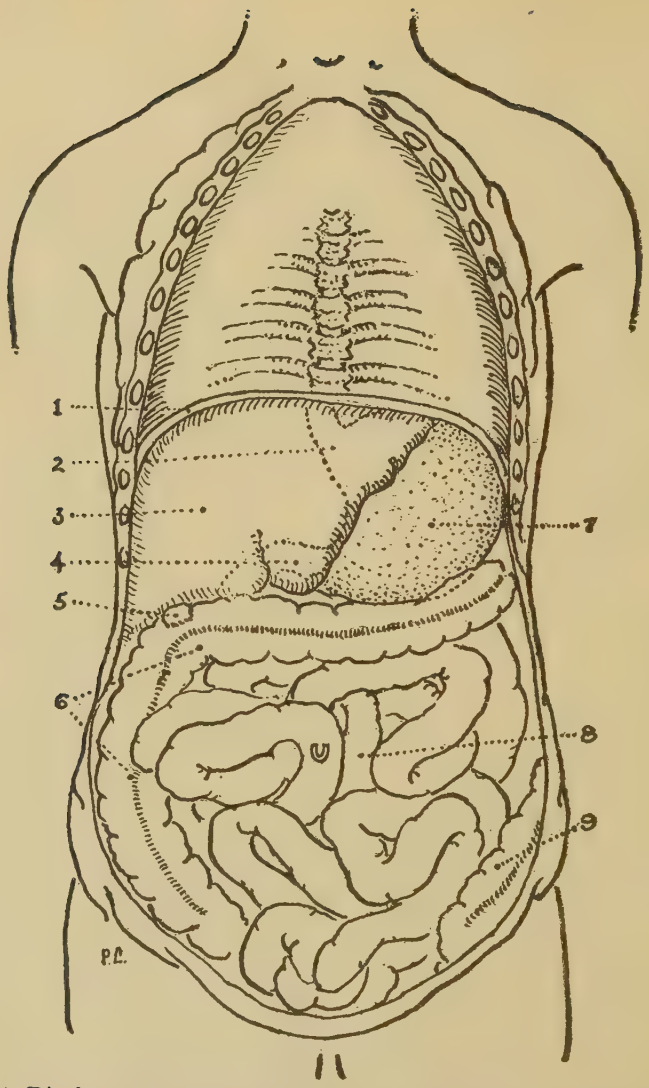
Year by year, unwilling witnesses of an appalling sacrifice, as fruitless as it is astounding, we physicians sit at the bedside of thousands upon thousands, chiefly of youths and maids, whose lives are offered up on the altars of Ignorance and Neglect.—Sir William Osler.

Life has two tap-roots—Secretion and Excretion.—John Scott Haldane, M.D., Fellow of Oxford University (England).

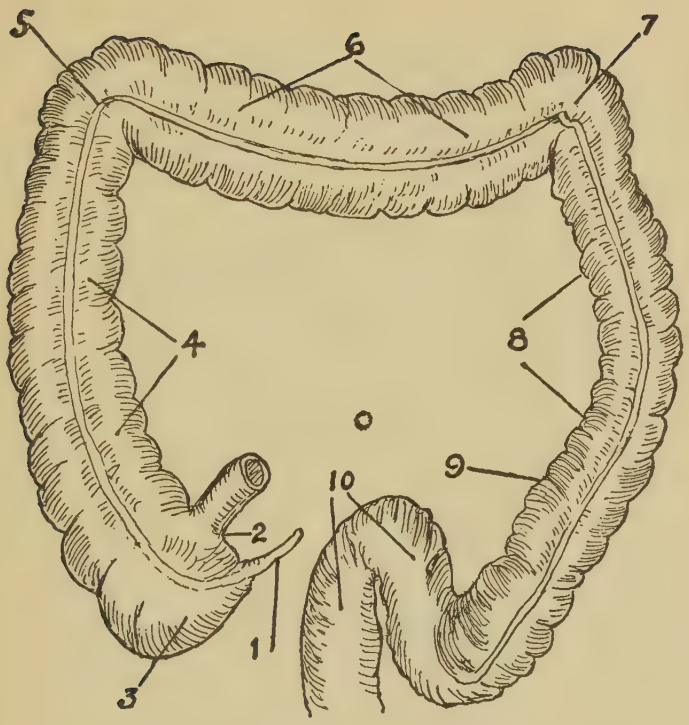
We are apt to dismiss from our minds unpleasant symptoms of bodily failure because in many cases people are reluctant to be anxious—indeed afraid to face anxiety.—Sir Edward Grey (*Autobiography*).

Few people continue to improve in later years for the want of energy. They never try an experiment, look up a point of interest for themselves, make a sacrifice for the sake of knowledge. Their minds, like their bodies at a certain age, become fixed.—Benjamin Jowett, *Introduction to his Plato.*

Medical Science has done practically all it can to eradicate mass diseases. The problem it now faces is to reach the individual and rid him of the ills which cause his death.—Dr. Charles H. Mayo, *Address.*

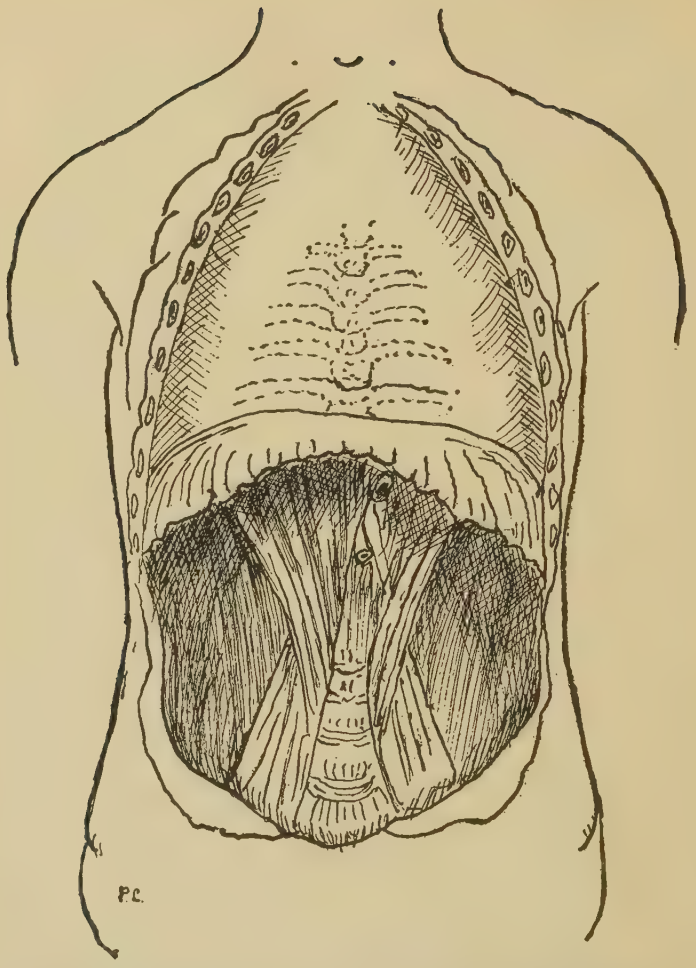


1. Diaphragm, separating the lung-heart cavity from the abdominal cavity. 2. Dotted line, opening into the stomach. 3. Liver. 4. Pylorus, outlet of the stomach. 5. Bile duct. 6. Lower line, ascending colon; upper, transverse colon. 7. Stomach. 8. Small intestine. 9. Lower end of the descending colon. U. Location of the navel (umbilicus). For lines of hip bone see cut p. 132.



THE COLON (after Sobotta).

1. Vermiform appendix. 2. Opening of the small intestine into the cecum (beginning of the colon). This opening is guarded by the ileocecal valve. 3. Cecum. 4. Ascending colon. 5. Hepatic (liver) flexure (bend). 6. Transverse colon. 7. Splenic (spleen) flexure. 8. Descending colon. 9. Crest of the left pelvic bone (ilium). 10 Sigmoid flexure (from the Greek sigma, ς) joining the descending colon, at the point where it passes within the left flank bone (ilium) and the rectum. It is subdivided into the upper section, lying within the bowl of the left flank bone, and the lower section, within the pelvis. Do not confound ilium with ileum, the lower section of the small intestine.



The upper or thoracic cavity (lungs and heart) separated from the abdominal cavity by the muscular-membranous diaphragm, that should be exercised in deep breathing.

THE LAZY COLON

Chapter I

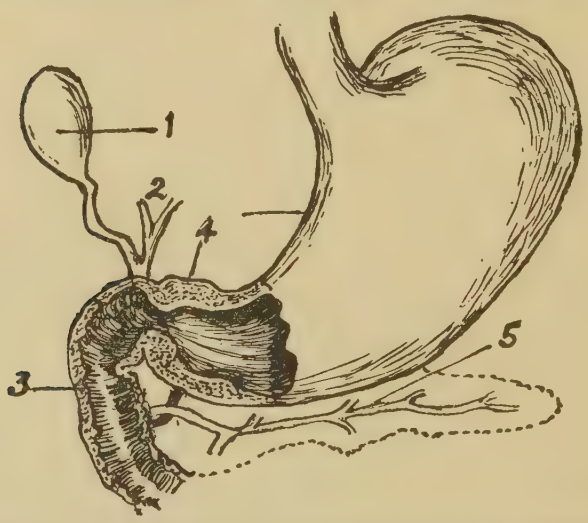
BIGGEST DIVIDENDS IN LIFE PAID BY A HEALTHY COLON

In a late book that has attracted much attention a famous surgeon lays great stress on the fact that failure of the nearly twenty-eight feet of small and large human intestine to function properly is the primary cause not only of much ill health but of a very considerable number of organic diseases (dealt with elsewhere.) As he specializes on abdominal surgery his conclusions are based on many observations.[1]

In a paper contributed to the same volume Sir Arthur Keith, of the Royal College of Surgeons, London, one of the highest authorities on the evolution of abdominal organs, says that soon after his appointment as a teacher of anatomy at the London Hospital in 1895, his attention was drawn to the large percentage of dissecting room subjects, particularly females, in which the abdominal organs were misshapen and displaced downwards. At the same time it was impressed upon him that a special action of the *muscular walls of the abdomen* is the chief means by which the abdominal organs are maintained in position since the time when we assumed an upright posture. One of these organs that is often displaced is the transverse colon which frequently sags well below the navel and sometimes reaches the floor of the pelvis owing to the load of effete material it is required frequently to carry.

[1] "Intestinal Stasis," by Sir Wm. Arbuthnot Lane, of London. A leading abdominal surgeon, consulting surgeon Guy's Hospital.

William Russell, ex-president of the Royal College of Physicians, of Edinburgh, observes that the transverse colon always descends with the stomach and is to be found along its lowest border, no matter how low that border may be. The stomach, however, may be normal

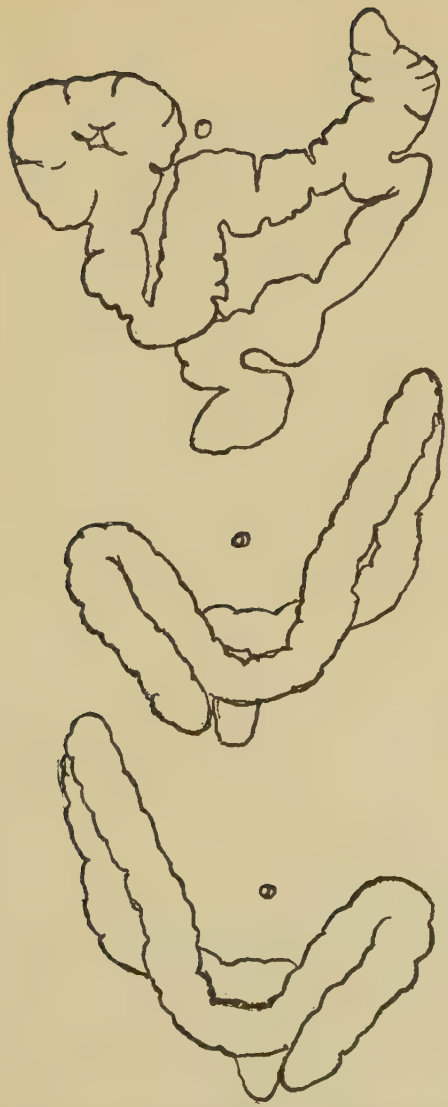


Stomach.—1, Bile bladder. 2, From the liver. 3, Small intestine, duodenum. 4, Pylorus. 5, Pancreatic duct.

as to position and yet the transverse colon form a great loop downward.[1]

Arthur F. Hurst, of Guy's Hospital, London, reports that in a skiagraph (x-ray) study of 15 normal young men in 1908, it was found that in an upright position the lowest part of the transverse colon is almost invariably situated well below the navel, even when the stomach is empty. In the majority of cases constipation associated with falling abdominal organs is due to the weakness of the abdominal and pelvic muscles and the falling of the diaphragm, (the muscular-membranous partition that divides the lung-heart cavity

[1] "The Stomach and Abdomen," by William Russell (1922).



Common forms of the displacement of the transverse colon downward (ptosis).

from the abdominal cavity). This condition is frequently worse in the upright position. One of the results is a pull and strain on the ligaments by which the abdominal organs (viscera) are suspended, generally described by patients as a weight or pressure of a dragging nature. The discomfort is most marked in people of weakened nerves.[1]

James T. Case[2] examined 30 women students who thought themselves in normal health. In 27 the level of the transverse colon reached well below the navel, (umbilicus), in many of them well down in the true pelvis. In only three was it as high as within an inch below the navel, even with the patient lying down. In but three was the lower border of the stomach up to the same line, with the patient standing. One of these three was short and stout so that both the stomach and transverse colon were higher than usual. One had duodenal ulcer (immediately below the stomach) and a third had gall bladder disease with adhesions. In the other 27 the lower border of the stomach averaged 2½ to 3 inches below the navel with the patient standing.

Hurst says the characteristic bulging of the lower part of the abdomen and retraction in front of the pit of the stomach (epigastrium) is due mainly to the falling of the small intestine. When stasis occurs in the cecum (beginning of the colon) and ascending colon these parts are constantly full and heavy instead of being empty from about 2 a.m. until 4 hours after breakfast. In such cases they are particularly apt to drop, as are all parts of the colon when similarly weighted, with the symptoms eased on lying down.

[1] "Constipation" (1919).

[2] Director of the X-ray (Roentgen) Department and Surgeon, Battle Creek (Mich.) Sanitarium. In general charge of x-ray work A. E. F. in France, 1917-18; late editor *American Journal Roentgenology* (N. Y.). From the Journal Iowa State Medical Society, Feb., 1916.

Chapter II

CONTRARY TO GENERAL BELIEF THERE IS LITTLE DIGESTION IN THE STOMACH

In a famous book in its day, "History of a Mouthful of Bread," by Jean Macé, republished in this country from the eighth French edition (1868), the author observes: "If your body were made of glass and you could watch your intestine at work, it would appear to you like a very long and large worm coiled into a bundle, moving and heaving with all its rings at once. You would never suspect there are such movements within you; yet they have been going on continuously since you were born." Now we can actually watch these movements by eating meals containing substances that are opaque to the x-rays (like barium or bismuth). As such a meal progresses from the stomach through the intestine the shadow of the barium defines the outlines of the organ with which it is in contact. By this and other methods involving the use of the x-ray it has been shown that the small intestine in particular is constantly in involved, tortuous motion.

The old idea of digestion was that it was largely a function of the stomach. This is not correct. Von Mering's experiments show that as soon as water is introduced into the stomach it begins to pass into the intestine by a series of spurts from the contractions of the stomach. Within a short time practically all the water swallowed can be recovered below the stomach, none or very little having been absorbed by that organ. Howell's "Physiology" states the case very conservatively when it says absorption of food does not take place readily in the stomach, certainly nothing like so easily

as in the intestine.[1] Starling's "Physiology" (1920) probably the leading English authority, says there is no absorption of water in the stomach, thus going a little further than Von Mering.

In passing from the stomach the contents, says Kellogg, are spurted some distance along the intestinal canal. The starches and sugars pass on most rapidly, next in order are the foods from animal sources (proteins) such as meat, cheese, eggs, etc., and lastly the fats. (This is a good place to note that these are the three classes of food: starches and sugars, *carbohydrates;* foods mainly of animal origin, *protein;* and *fats.*) Bread, continues Kellogg, begins to enter the small intestine within ten minutes after eating (providing, he says elsewhere, it is not too fresh and is well cooked). Potato leaves the stomach rapidly, perhaps because it is acted upon in the stomach only to a very small extent. At the end of half an hour eight times as much carbohydrates have left the stomach as have proteins. Fat remains long and retards the passage of both carbohydrates and proteins when it is present in considerable amount (hence the undesirability of food fried in fat, much "shortening" in biscuit, pie crust, etc., which incorporated fat retards carbohydrate digestion). Where there is an excess of acid in the stomach fluids it delays progress of the meal by causing a prolonged closure of the discharging end of the stomach (pylorus), a fact that has relation to the use of vinegar as food.[2]

Examination of the contents of the intestine in the duodenum (immediately below the stomach), which receives the contents of the stomach, and about 23 feet lower down at the valve separating the small from

NOTE. A biographical footnote of a medical authority, where it is considered advisable, is given but once although he may be quoted several times. To find these footnotes *consult the index.* Matter not indicated is original.

[1] William H. Howell, of Johns Hopkins.

[2] Vinegar: Acetic acid is harmful to digestion as first demonstrated by Sir Wm. Roberts. A teaspoonful of vinegar will at once arrest the process of salivary digestion in the stomach. Vinegar, as well as pickles and all substances containing this acid, should be banished from the table. Kellogg ("New Dietetics").

the large intestine (colon), shows that the products formed by digestion have largely disappeared in traversing this distance. All the information we possess indicates that the small intestine absorbs readily.[1]

The prevailing idea of digestion is that it is largely a function of the stomach and that the stomach readily absorbs such things as the end products of protein food (peptones), sugar, salt, etc. Actual experiments, however, says Howell, made under conditions as nearly normal as possible, show, upon the whole that absorption does not take place readily in the stomach. Von Mering and Brandl, quoted approvingly by our author, found that sugar of ordinary dilution and sugar formed from the starchy foods of the ordinary meal, pass into the small intestine for further digestion and absorption. With a definite amount of protein introduced in the stomach of an experimental animal, it could all be recovered from an opening into the duodenum (the first intestinal section below the stomach), by a duodenal fistula (bringing the intestine outside through an artificial opening in the side). So that the products of preliminary stomach digestion after being worked up in the lower end of the stomach are passed on in the form of a mildly-acid semi-fluid mixture called chyme, which is combined with pancreatic juice, bile and intestinal secretions. Thus real digestion begins in the duodenum.

It is an important matter to assist Nature to empty the stomach after a meal, especially where the stomach is weak (deficient motility). Upon lying down when it still contains food (the minimum emptying period being 3½ hours) the patient should always lie upon the right side, thus lowering the discharging end of the stomach and bring gravity to the aid of the weakened organ. This is a wise precaution even with well people in the opinion of Kellogg.

[1] Howell's Physiology.

NOTE—For cut of the stomach see page 12.

Chapter III

HOW MISCROSCOPIC PLANT LIFE PROMOTES PUTREFACTION IN THE COLON

The microscopic organisms commonly called bacteria are also known in the popular mind as germs, microbes, micro-organisms, bacilli, and micro-cocci, while a New York magazine recently called them bugs. In the middle of the 19th century they were known only to a few experts and were looked upon as curiosities of the microscope, chiefly interesting for their large numbers, minuteness and activity. No one dreamed of them being of importance to man. Now we have entire laboratories solely for their study and large libraries devoted to this one subject.

For our purpose it is not necessary to go further than to classify the great number of bacteria of importance to the life and health of man into two simple groups: the *coccus* (plural cocci) of a round, ovoid form; the *bacillus* (plural bacilli, Latin diminutive for rod), generally of a rod-shaped or elongated form, varying much in shape and size. Thus the twisted rods are called spirilla. They divide transversely and may be found in threads or chains. These cocci and bacilli (cocci and 'cilli for short) are embraced under the name *bacteria* which is the general term used when speaking of micro-organisms.

Bacteria, usually thought of by the layman as living microscopic animal organisms, are in fact classed as plants. Kendall [1] says, however, they exhibit several prominent characteristics which suggest relationship with

[1] A. I. Kendall, Professor of Physiology in the Northwestern Medical School, Chicago, in his work "Bacteriology, General, Pathological, Intestinal." Second Edition, 1921. Lea and Febiger, Philadelphia.

the lowest animals. The most important of these is the absence of chlorophyl (the green coloring matter of plants). This indicates very clearly their dependence on preformed food and implies an analytical or destructive function. One of the achievements of the Great War is a noteworthy advance in the science of bacteriology. This is manifested not only in marked improvements in methods of investigation and in modifications of pre-existing views in the important fields of infection and disease prevention, but also in a complete revision of some of the more important groups of bacteria.

Bacteria are structurally the simplest known organisms which maintain an independent existence. All their vital functions are exhibited in a single asexual (non-sexual) cell, devoid of a definite nucleus (central point). Reproduction is by division. Successive generations may appear at intervals as frequent as every fifteen minutes. Many bacteria may, however, require hours or even days to arrive at maturity. Many living on dead or decaying organic matter form spores (corresponding to seeds in plants) for the continued vegetative growth of the organism. Spores have been dried and kept in a cool place for more than twenty years and yet when placed in a favorable environment developed anew with their usual luxuriousness. Practically, the average duration of life of bacteria is comparatively brief, from a few hours for gonococcus (the specific organism of gonorrhea, a sexual disease) to two or three months for the bacillus of tuberculosis. They may be frozen solid and kept in that condition for weeks without killing all the individuals. At the end of four weeks 95 per cent of frozen typhoid bacilli have succumbed. From four to six months' continuous freezing is required to kill all of them. Many bacteria which are killed by an exposure of from one to two hours of direct sunlight in summer require an exposure of from two to three hours in winter. A single red human blood corpuscle weighs about 0.00008 of a milligram, (8-100,000 of the smallest measure of weight in the metric system) which is fifty thousand times the weight of a single colon bacillus.[1]

[1] Same.

Many kinds of bacteria may theoretically find conditions well adapted to their rapid development (in the intestine) and it is not surprising to find that bacterial proliferation (development by offshoots) is greater in both nature and extent in the intestinal tract than in any other known medium. It has been estimated that the average daily fecal excretion of bacteria from a healthy adult on a normal diet is expressed by the truly enormous number of 33×10^{12} (multiply 10 by itself 12 times and that by 33). The upper level of the intestinal tract, particularly the duodenum (the upper section of the small intestine), is relatively free from them during interdigestive periods. They increase rapidly as food enters the duodenum and decrease when the food passes to lower levels. The number increases very greatly where stasis (delay) of food becomes more marked and in the cecum and large intestine they are continually present in enormous numbers. The majority of these organisms, however, particularly the coccal forms, are to be regarded as opportunists —they do not initiate disease as a rule. They are to be regarded as Theobald Smith has called them "organisms of the diseased state," because of their invasion of the body secondary to other diseases. Even the tubercle bacillus and the diphtheria bacillus, particularly the latter, have been found in the mouths of men who apparently have had neither tuberculosis nor diphtheria, yet these organisms appear to be virulent when tested in the usual manner, and presumably might be able to incite disease whenever conditions favor their entrance to the tissues of the body that are, owing to debility or other causes, in a proper state of receptivity.[1]

The idea that prevails in many quarters that bacteria are an evil that must be endured is erroneous. They are not only generally regarded as belonging to the vegetable order but their function throughout nature is very generally beneficent and essential to life. In the human organism, for instance, the meats and other proteid foods are broken down by them (catalysis) and by such decomposition the food is made available for the uses

[1] Same.

of the body. Each kind of food reacts to its own variety among these organisms.[1]

Putrefaction and fermentation are physiologically two important and interesting words, intimately associated with digestion and constipation, that are frequently misused. Putrefaction represents a form of bacterial activity (decomposition) related to protein material (food derived in the main from animal sources); fermentation, to starches, sugars and closely-related compounds (carbohydrates). A most interesting fact, says Howell, is that each food element has its own digestive ferment (enzyme). The enzymes that act on carbohydrates are not capable of affecting the proteins and fats and *vice versa*. So in the fermentation of closely related bodies such as maltose (sugar derived from starch by the action of diastase or malt), sugar of milk (lactose) and common cane sugar, each requires seemingly its own specific digestive ferment, or enzyme. Each ferment seems adapted to act upon or become attached to the smallest quantity or unit of a substance that can exist separately with a certain definite structure (molecule) and is fixed to it, in fact, as a key to its lock.[2]

This word enzyme was first applied to phenomena indicated by bubbles of gas, as in alcoholic fermentation, in which alcohol is formed from sugar; the acid fermentations, as in the souring of milk; and the putrefactive fermentations by which animal substances are disintegrated. The brilliant work of Pasteur established the fact that fermentations in the old sense are due to living organisms, which led to the present day classification, the grouping of ferments into two great groups: the living or organized ferments, such as yeast cells, bacteria, etc.; and the non-living or unorganized ferments such as pepsin, trypsin, etc. These latter came to be generally designated as enzymes. Later discoveries, however, clearly indicate that there is no essential difference

[1] Same.

[2] Digested from Howell's "Physiology" (Saunders, 1921) by Wm. H. Howell, dean of the medical faculty, Johns Hopkins, 1900-1911; professor of physiology since 1893.

between living and non-living ferments.[1] The underlying physical causes of fermentation, like many other mysteries of Nature, are not yet worked out and may never be.

[1] Same.

Chapter IV

SURPRISING THEORIES OF WATER DRINKING

Any large loss of fluid to the body, as by sweating, diarrhea, hemorrhage, gives rise to an intense thirst that has its natural reaction in increased intake of water by the mouth. On the other hand, the property possessed by the alimentary canal of absorbing water and weak saline fluids contained in its interior is very little influenced by the state of depletion, or otherwise, of the water contained in the body. It is practically impossible, in the opinion of Starling (controverted later), however large the quantities of fluid ingested, to evoke the production of fluid motions, the greater part of the ingested fluid being absorbed on its way through the alimentary canal. Thus a man may keep himself in perfect health and maintain the water content of his body constant whether he take one litre (half a gill over a quart) or six of water daily. The whole process of regulation, apart from that determined by the appetite, is carried out at the other end of the cycle—by the kidneys. As concerns absorption of water, there is no chemical solidarity between the alimentary (intestinal) surface and the rest of the body. Whenever water is presented to this surface it is absorbed and passed into circulation.[1]

The absorption of water in the stomach may be regarded as nil. The chief absorption occurs in the small intestine. The intestinal contents at the ileocecal valve (the junction point of the small intestine and colon) contain relatively nearly as much water as they do at

[1] Starling's "Physiology," 1920. Ernest Henry Starling, Jodrell professor of Physiology, University College, London, demonstrator of physiology, 1889; lecturer on physiology at School of Medicine for Women, 1898; Croonian lecturer Royal Society, 1904; Baly medalist, 1907; medalist of the Royal Society, 1913. Author of seven volumes on physiological subjects that occupy the front rank.

the upper part of the jejunum (middle section of the small intestine). Their absolute bulk, however, is much smaller, so that only a small proportion of the water that has been taken in by the mouth remains to be absorbed in the colon—an amount probably much less than that which has been added to the contents of the small intestine in the form of secretion by the stomach, liver, pancreas and intestinal tubules.[1]

P. B. Hawk, a physiological chemist, has made some careful studies of the effect of water drinking on health, extending back for upwards of two decades, which he has published from time to time under the general title *Studies in Water Drinking*. He was particularly anxious to discover if the popular notion that water should not be drunk in quantity during meals for the reason that it dilutes the gastric juice is a sound one. His conclusion in one of his first papers, published in the *Journal of Experimental Medicine* in 1910, was that this notion is wholly erroneous. He then concludes that what took place in his experimental water drinking, greatly in excess of ordinary practice, up to 1 liter during the progress of each meal (one liter = 1.056 U. S. quarts), as far as the digestive mechanism was concerned was that the entrance of the large amount of water into the stomach stimulated the flow of gastric juice, thus facilitating the digestion of the protein constituents of the diet. The strongly acid chyme (semi-fluid stomach contents) passing into the intestine caused a pronounced stimulation of the pancreatic secretion (discharged into the small intestine from the pancreas). The products of incomplete gastric digestion were consequently more rapidly and thoroughly digested. The coursing of the large volume of water through the small intestine so stimulated the absorption that the products of intestinal digestion were absorbed with increased rapidity and thoroughness. The intestinal bacteria, therefore, found less pabulum at hand and in consequence these micro-organisms were less nourished than usual, a fact demonstrated by a decrease in the output of bacteria and of bacterial nitrogen. The effect of this stimulated di-

[1] Starling.

gestion, absorption and assimilation was noted at once in the increased body weight of the subject.[1]

During the preliminary period the subject excreted 105 grams of fresh feces a day. Under the influence of the water drinking the daily output was reduced to 74 grams, whereas the final period was 97 grams a day. Calculated to a dry basis there were 23 grams of dry excretion per day during the preliminary period against 17.5 grams for the water period and 20.4 for the final period (this final period was the 17th, 18th and 19th days, when the normal nitrogen elimination by the urine had been reestablished).[1]

It has been calculated that about 80 fluid ounces, 2½ quarts, of water pass the ileo-cecal valve into the colon every 24 hours.[2]

Hawk says in another paper, 1911, that the amount of water in the colon output during the water period (a liter with each meal) was less than during the preliminary or final periods, showing that even with the large amounts of water sent into the intestine the amount absorbed was actually more than the excess administered. The findings obtained in this experiment, he says, show that during the periods when large amounts of water were taken with meals the total amount of dry matter and moisture was less than without these unusual amounts of water, and that more or less permanently better utilization of carbohydrates accompanied the water drinking.

An interesting feature in the large intestine is the marked absorption of water. In the small intestine water is absorbed, no doubt, in large quantities, but its loss is evidently made good by osmosis, or the secretion of water into the intestine (through the intestinal wall), since the contents at the ileocecal valve are *"quite as fluid as at the pyloris"* (discharging end of the stomach). In the large intestine the absorption of water is not

[1] P. B. Hawk was graduated in Medicine at Yale, 1902; Columbia, 1903. Demonstrator physiological chemistry, Dept. of Medicine, University of Pa., 1903-7; Professor of Physiological Chem. and Toxicology, Jefferson Medical College, Phila., 1912. In the paper quoted herein he was associated with C. C. Fowler of the University of Illinois.

[2] Starling.

compensated by a secretion. The material loses water rapidly while in the ascending colon, and before it reaches the descending colon it has acquired the ordinary consistency.[1]

[1] Howell's "Physiology."

Chapter V

THE FOREGOING CONCLUSIONS SHARPLY ANTAGONIZED

The foregoing deductions of Hawk are apparently opposed to ordinary human experience, but are not for that reason to be rejected. Hawk, it seems, was not satisfied, for he continued his experiments and published them in 1919. In quoting his later conclusions the reader will note that his phrase "flushed out of the system" can apply to the urinary as well as the bowel function. If you are normal, Hawk says, by all means drink all the water you wish at your meals. The food is thus more thoroughly digested and its digestion products are more quickly and completely absorbed. Various materials which are poisonous in character are flushed out of the system and harmful bacteria do not thrive so well in the large bowel. All these things promote increased mental and physical efficiency. Some types of kidney disorders have been shown to be benefited by drinking large volumes of water whereas other types might possibly not be so benefited.

The drinking of water immediately before a meal is a good practice. It will cause the appearance of digestive fluid in the stomach. Therefore when the food reaches the stomach it is more rapidly digested than it would have been if no water had been taken.[1]

It is also good practice to drink water immediately after a meal. The stimulation thus afforded permits the stomach to handle its burden more efficiently.[1]

We often hear the expression "on an empty stomach." As a matter of fact the human stomach is never empty. In the early morning before breakfast, the normal

[1] Same.

stomach contains on the average about a fifth of a glass of fluid that generally possesses at least a faint blue, green or yellow color, due to the bile or other fluids that have passed from the bowel up into the stomach during the night. If the individual was the victim of a banquet or party the night before the stomach may contain nearly a glassful of the residuum filled with undigested and indigestible residues of the so-called food he was called upon to eat.[1]

A glass of water, either hot or cold, serves to stimulate the formation of fresh gastric fluid as well as the motor action of the stomach. Consequently, this colored residuum which has been diluted by the water is passed quickly from the stomach into the bowel, leaving normal gastric juice in the stomach ready to digest the food to be eaten at breakfast.* It has been shown by experiment that very soon after water is drunk its presence may be demonstrated far down in the intestine.[1]

Some individuals derive the most satisfactory results from hot water. It raises somewhat the bodily temperature, which is slightly subnormal in the early morning.[1]

The amount of water one should drink a day depends on such factors as body weight, vocation, season of the year, character of diet, etc. One general statement, however, can be made with certainty—the great majority of people drink far too little water. It has been claimed that three pints of water are sufficient for the average man or woman per day. This is rather low. In order to derive the maximum benefit from our food we should drink at least three pints of water at meals alone, that is two glasses with each of the three meals.[1]

In order to further facilitate absorption and the gen-

[1] Same.

* Three glasses of water 1¼ hours before breakfast is recommended by good authorities. No more than two should be taken until the larger quantity can be borne. At the spas (baths) in Europe the drinking of the water before breakfast is encouraged up to half a dozen glasses and even more. Carbonated water is frequently available.

eral flushing of the system,* with its consequent removal of poisonous substances, at least one pint additional should be drunk between meals, in the early morning and before retiring. In other words the water schedule of the average man or woman should call for at least two quarts of water per day (eight glasses) rather than three pints. In case one drinks considerable milk, which is 87 per cent water, the water quota may be appreciably lower. If one eats freely of fruits and vegetables less water is required, since these foods have a high water content. If one exercises vigorously in a warm climate the water ingestion should be considerably increased.[1]

For example, Hawk has known a man weighing 150 pounds to lose eight pounds in the three hours of a fatiguing tennis contest on a scorching hot day.

In the Biological Bulletin for April-July, 1914, Hawk goes into details on the large percentage of water in the human body; that the gastric juice is 98 per cent water, the blood over 90, the intestinal juice 98 and that efficient intestinal digestion is greatly promoted by a large intake of water; that even where the stomach is full the water will not be retained in the mixture but pass on through a channel. Much misinformation is current on this subject. He also points out that a large intake of drinking water, whether distilled or ordinary, acts as a deterrent of intestinal putrefaction, and also calls attention to the improvement in the character of the urine under full intakes of water. Of this more anon.

Kellogg in his "New Dietetics," says of the foregoing theories of Hawk (whom he designates as a Chemist of Philadelphia) that they have been particularly misleading and dangerous. He says the author would have us believe that drinking freely of even ice water at meals does not involve risk of indigestion. The professor's experiments simply demonstrate how much abuse a healthy stomach is able to endure before it surrenders

* As our author has just said that drinking a liter of water at mealtime does not increase the colon moisture, this phrase "flushing of the system" must refer to the kidneys. See comment later.

[1] Hawk.

to disease. Because, Kellogg says, it seems to make little difference to a healthy stomach whether bread is stale, and hence quickly digested, or fresh and slowly digested, it cannot be assumed it makes no difference to a weakened stomach. This principle applies to all sorts of unhygienic practices including excessive water drinking with meals. Prof. Pavlow showed that taking a quantity of water into the stomach gives rise to the production of an increased amount of gastric acid. The increase is not so great as to cause any serious disturbance in a healthy stomach, but in the case of a stomach which is already making an excess of gastric acid, the drinking of a quantity of water may be the means of greatly increasing the difficulty. Thus it is an easy inference that the habitual use of liberal quantities of water in connection with meals, like other gastric stimulants, will in time produce pronounced hyperacidity. A glass of water at meal time is not harmful to the ordinary person, but the practice of drinking water to wash food down is very injurious. Those whose stomachs are already producing an excess of acid, which class is a large one, Kellogg says elsewhere, should avoid water drinking at meals, as well as the use of broths and thin soups. In the feeding of milk to many hundreds of patients subjected to the milk regimen, experience has shown that the taking of milk slowly is so important that the patient is required invariably to draw it through a straw or a small glass tube. In this way a person may take as much as six quarts a day without difficulty which may otherwise result in the production of dangerous curds. In one such case where the patient had swallowed several glasses of milk this curd, in the form of a rope, was felt in his throat several hours after. Reaching in, the author succeeded in getting hold of it with his fingers and pulled it out. The distinguished English surgeon, Dr. Lawson Tait, told Kellogg of a case in which he was obliged to remove a similar mass of curds which had lodged low down in the intestine.

While Kellogg does not mention it, Hawk at page 401 of the *Journal of Experimental Medicine,* volume 12,

quotes with approval the statement of Foster and Lambert that when water is added to the diet, the gastric juice is not only increased but becomes more acid.

At page 482, Kellogg says, the daily loss of water from the body is about 4½ pints. Ordinary food, as eaten at the table, contains water to the extent of about one half its weight. About 12 ounces of water are produced in the body by the reactions which occur in the processes of digestion, assimilation and dissimilation. To supply the daily loss at least 2 to 4 pints should be drunk.

Referring elsewhere to the practice of Priessnitz, of Grafenberg, Germany (the originator of hydrotherapy, or water cure), in requiring the drinking of as high as 20 to 40 glasses a day, which is still recommended by German water-cure empirics, Kellogg approves the practice up to 6 to 10 glasses a day as a method of treatment. He says water drinking is especially indicated in all cachexias (a depraved condition of general nutrition) and diatheses (a *predisposition* to certain diseases like tuberculosis, gout, etc.). In rheumatism it is useful in diluting the blood so that it can dissolve and carry out of the body a larger amount of waste matters.* As a means for encouraging activity of the skin and kidneys and diluting the urine free water drinking not only promotes the elimination of excess sugar in the blood in diabetes but lowers the specific gravity of the blood and aids in the elimination of acetone (found in the blood in diabetics) and diacetic acid (sometimes associated with diabetes). In insipient diabetes the disposition to drink large quantities of water should be resisted to a moderate extent, water being taken only when the thirst becomes very intense. In fevers water drinking aids the kidneys and skin in eliminating body poisons to which the rise of temperature is due, in aiding the liver in its work of destroying fever poisons and promoting the reductions of temperature by causing increased evaporation from the skin.

In health when the amount of water supplied to the body is insufficient the condition of the body can be com-

* Note here that Kellogg confines the dilution to the blood, the excess of water being excreted by the kidneys.

pared to a stagnant pool, while an abundance of liquid so encourages its activities that it may be compared to the flowing mountain stream. It is one of the most effective means of relieving a common cold by aiding in the elimination of tissue poisons.[1]

[1] Same.

Note to Sixth Edition

The views of the authors on the somewhat contradictory theories of water drinking in Chapters IV, V and VI are as follows:

1. The amount of water required by the human body during a day is eight glassfuls, 64 ounces, two quarts. In hot weather with considerable perspiration the equivalent in amount of the perspiration should be added to two quarts.

2. An hour and a quarter before breakfast three glasses of cold water of a minimum temperature of about 60 degrees, in winter time, should be taken. If this quantity is repellent then two glasses of cold water may be followed in five minutes by a glass of warm water.

3. A glass of water should be a part of luncheon and dinner, with a glass in the forenoon and one in the afternoon. The eighth and last glass of the day should be taken upon retiring for the night.

Any other liquid such as milk, soup, tea, coffee, fruit juice, etc., may be counted as the equivalent of water to reduce the number of glasses during the day.

When water is taken with meals it should not be allowed to wash food down, but swallowed when the mouth is empty.

Water, next to air, is the most important requirement of the body, of which about 66 per cent is water. Even the bones are half water. As the percentage of water in the body falls below normal, the fact is immediately apparent in the urine, which becomes more condensed, of heavier specific gravity, darker in color, of greater acidity and more odoriferous. The dilution of the urine, which is poisonous, sometimes to the kidneys themselves, therefore becomes a matter of great importance to health. If retained in the body for a very few days uremic poisoning sets in with fatal results. Urine should be kept under observation by being frequently caught in a vessel. Like the coated tongue, dry hair, yellow skin and other signs of plain import it often carries an easily read message of impending danger.

Chapter VI

OVERLOOKED FACTS IN WATER DRINKING

Important facts in water drinking are overlooked in the foregoing somewhat contradictory observations.

Thus Starling says there is relatively nearly as much moisture at the lower end of the long small intestine as there is at the upper. Hawk says that soon after copious water drinking the water can be demonstrated far down in the small intestine. Starling further observes that no water is absorbed from the stomach and that water drinking does not produce fluid motions although about 2½ quarts of water pass the ileocecal valve into the colon in 24 hours. Howell states that as the food residue advances through the colon its moisture decreases and confirms Starling in the statement that it gains little moisture by secretion. Hurst observes that dryness of the colon is a condition of practically all forms of intestinal stasis and that women who suffer from the condition are notoriously poor water drinkers. Kellogg has observed that water on the empty stomach is much more effective and acts differently than when taken with food; that fluidity of the colon contents is produced by milk drinking (87 per cent water) and that milk soured by digestive ferments when drunk copiously is freely present in the colon. Finally Hawk says he has demonstrated that when a large amount of water is drunk at meals the colon moisture decreases, thus showing a stimulation of the power of absorption.

Despite his high reputation as a physiologist the observation of Starling that the drinking of water does not bring about the fluidity of the colon contents is believed not to be based on the facts. By his own statement the amount of moisture on the two sides of the

ileo-cecal valve (at the end of the small intestine) is practically the same. If there is serious stasis (delay) in the colon his observation will apply. But where there is a rapid movement through the colon, sometimes, according to Hurst, in as short a time as two hours, it is quite evident that an observation on the dryness of the contents that will apply to one condition will not apply to the other. Thus it has been observed by competent investigators that in people who still retain their strength, particularly if they are under 40, and have no organic impediments, the drinking of three glasses of water, either all at one time or within half an hour, the last an hour or an hour and a quarter before breakfast, when the water has a free right of way through the small intestine, the moisture in the colon will become pronounced and effective almost without exception. If there is a serious impaction of the lower bowel this must first be relieved by enema, thus supplying moisture where most needed. In all cases where a prompt movement through the colon can be secured (that is where there is no organic obstruction) it seems a safe deduction that there is such a thing as semi-fluidity of the contents from water drinking. The reason seems not far to seek. There is not enough time allowed for the absorption of the moisture as is the case where there is stasis. Kellogg supports this conclusion by his observations of the full presence of milk in the colon after it has been copiously imbibed, it being 87 per cent water, and Webster in "Diagnostic Methods" says many factors may influence the amount of water present in the colon output, one of which is the large intake of water. Goiffon, a competent French observer, also states that the decrease of moisture and bacteria corresponds to the time occupied by their passage through the colon.[1]

The mechanics of the problem are simple and it is easily within the power of each patient to prove or disprove the soundness of the theory.

The difference of effect in drinking hot water or cold before breakfast lies in the fact that water at body temperature leaves the stomach more rapidly than cold

[1] In "Archives des Maladies de l'Appareil Digestive," 1911.

water. Many people can bear three glasses of either warm or cold water an hour or more before breakfast without the slightest discomfort. This volume makes a prompt impression on the colon at a time when the small intestine is empty and peristalsis is renewed with the eating of breakfast. Or two glasses of cold water can preferably be taken, to be followed in five minutes by a glass of warm water. This method secures the stimulation of the cold water before the warm is taken. Such an early morning washout of the stomach not only relieves that organ of any overnight fluid residue, possibly acidu-ous, referred to by Hawk as a frequent condition, but relieves the kidneys by diluting the blood.[1]

In considering the great value of three glasses an hour or more before breakfast, the time depending upon the activity of the stomach and kidneys of each individual, allowance must be made for the percentage of absorption as the water progresses through the nearly 23 feet of supposedly empty small intestine, not more than half of it possibly, especially in warm weather, or when there is perspiration from exercise, reaching the colon. When it does, its effect must be distributed through an organ nearly five feet long. In practically all cases it must be supplemented by bran and abdominal exercises.

After a few months the patient can tell by the sensation in the stomach when it has disposed of the before-breakfast water ration. The addition of the juice of one or two oranges is an agreeable and palatable addition to the water aside from the vitamin value of the fruit.

[1] Baruch's law: the effect of any hydriatic procedure (use of water) is in direct proportion to the difference between the temperature of the water and that of the skin; when the temperature of the water is above or below that of the skin the effect is stimulating; when the temperatures are the same the effect is sedative (quieting).

NOTE TO SECOND EDITION.—Many stomachs are deficient in emptying power (motility). Such people require a 2-hour period for water drinking before breakfast. Cold water is much more effective than warm. Not a few drinking waters have astringent qualities for many persons. This complaint is made, for instance, of the Atlantic City water. By "cold water" is meant a temperature in winter not below 62° to 65° F.

NOTE TO THIRD EDITION.—If one arises in the night a glass of water should be taken, for reasons set forth above.

Chapter VII

MYSTERIES OF THE INTESTINE REVEALED BY X-RAY INVESTIGATORS

Hurst is of the opinion that unfortunately it is not possible to make a diagnosis of intestinal stasis (constipation) from symptoms alone. The worst case he has ever seen of intestinal toxemia (poisoning), with the classical symptoms of extreme emaciation, extensive pigmentation, evil-smelling sweat and cold extremities, was not due to chronic intestinal stasis but to chronic diarrhea, the result of some obscure infection, contracted by a lady while game hunting in Africa.[1]

One who is suffering from chronic intestinal stasis should as a first step *carefully locate the seat of the trouble.* The best practice is to have a bottle of 100 large charcoal tablets (5 grains each) in plain view where it will act as a frequent reminder. As a first trial chew and swallow four of them and wash down immediately after dinner. If this charcoal is out the next morning, *and does not keep on coming out for two or three days thereafter,* the patient is in excellent condition as to stasis. If conditions are unsatisfactory the interval between taking the charcoal marker and its reappearance must be lengthened by taking it earlier in the day until

[1] Arthur F. Hurst, born 1879, neurologist and lecturer on Therapeutics, Guy's Hospital, London; educated Magdalen College, Oxford, Guy's Hospital (University Scholar), Munich, Strassburg, Paris, America. First Class final honor School of Physiology, Oxford, 1901; gold medals in medicine and surgery, Guy's Hospital, 1904; Radcliff prize, Oxford, 1909; lecturer on materia medica and pharmacology, Oxford; Gouldstonian lecturer on the Sensibility of Alimentary Canal in Health and Disease, Royal College of Physicians, 1911. Publications: "Constipation and Allied Intestinal Disorders," Oxford Medical Publications, second edition, 1919, from which we quote; "Diseases of the War," second edition. Papers on Medical Subjects; editor of Seale Hayne Neurological Studies and Guy's Hospital Reports.

the efficiency of the colon is fully and accurately determined. Hurst says if the charcoal is taken at 4 p. m. and some of it is not passed at the latest on the second morning the patient must be regarded as constipated.

This English view will not be accepted by Kellogg, for instance, who insists that there should be an action of the bowels after every meal, with an additional one at night if possible. Whether this view is accepted or not there is little doubt of the non-acceptance of the Hurst theory by people of fastidious personal habits. The taking of a charcoal marker should be a common practice, at least as frequently as there is such loss of appetite and lack of energy as is indicative of impaired intestinal function. Thus many people will learn with great surprise that *regularity* is frequently very far from being the same condition as *intestinal efficiency*. This excellent first step, however, has the great disadvantage of giving no indication as to the part of the colon in which the stasis occurs. Although the fluoroscope is nearly always used for the purpose of obtaining this information (as discussed elsewhere in this chapter) yet it can be obtained with some accuracy in people who are not fat by palpation (feeling) with the fingers along the course of the colon. In such cases the transverse colon will nearly always be found well below the umbilicus (navel) and near this point hard masses are apt to be felt and thus located.[1] If the rectum is at fault a small irrigation of cool water should promptly relieve it. If the colon is tender under slight pressure, such line of tenderness may indicate its course in a general way.

The two points at which the stasis is most apt to occur are in the region of the cecum (beginning of the colon) and the lower or distal part of the bowel. The first named location is called *colic constipation* and the latter, *dyschezia.*

There is but one method uniformly accepted by the best authorities, of which Hurst is an excellent example, in locating the point of stasis accurately, and that is by means of the fluoroscope and barium sulphate meal, which is opaque to the x-rays. The fluoroscope is an instru-

[1] "Colon Hygiene" (digested).

ment for holding the fluorescent screen in x-ray examination. No skiagram, or printed x-ray picture, is recommended. With the fluorescent screen the condition, as the meal progresses, is brought under observation and the outline of the colon can be then traced on a piece of leaded glass placed over the screen from which it can be copied.

Although barium meals are the best means of obtaining information of the motor functions of the colon, barium enemata generally give earlier and more exact information concerning the possible presence of a stricture, displacement or distention. This is especially the case with stricture of the pelvic colon (lower part of the descending colon), which cannot always be satisfactorily examined by the former method.[1]

Several authorities have uttered warnings against unscientific and incompetent use of the x-rays in the examination of intestinal stasis. Hurst says in a recent discussion at a London medical society cases were related by various speakers in which a diagnosis of intestinal stasis was made, although the time at which different parts of the bowel were reached by the barium meal fell well within normal. Thus one speaker concluded that the presence of bismuth between the hepatic flexure and pelvic colon (see diagram) thirteen hours after the meal in one of his cases suggested some mechanical difficulty in the left iliac fossa (the pelvic colon). It would be rare to find less evidence of stasis in a normal individual.[2]

All figures as to the progress of a barium meal in normal individuals are based on averages, and an average must not be taken as a figure to which all must comply in order to be considered normal. In calling attention to frequent errors caused by a wrong deduction from average figures Hurst says that in fifty-eight healthy individuals examined by Alan Newton seven hours after a bismuth meal, the furthest point reached by the bismuth was the cecum in four patients, the ascending colon

[1] Hurst.

[2] On the mechanical side Kellogg says many so-called operators are incompetent.

or hepatic flexure in twelve, the transverse colon or splenic flexure in thirty-one and the descending or pelvic colon in eleven. Though the average furthest point is the

Normal intestine with the normal progress of a meal marked in figures representing hours. (After Hurst.)

transverse colon, it would be clearly incorrect to say that stasis was present in an individual in whom the bismuth had not reached beyond the hepatic flexure after seven hours.

NOTE TO THE SECOND EDITION

With reference to the difference of opinion at top of page 37, one complete action a day should be the minimum.

Chapter VIII

SOME CURIOUS CAUSES OF INTESTINAL STASIS

It is not very rare, says Hurst, to find people in perfect health who defecate regularly two or three times a day, and others with more greedy colons who do not do so in two or three days, without apparently suffering ill effects. There have been many cases observed in which the bowels acted at still longer intervals. A patient told Goodheart that her bowels moved regularly which, upon inquiry, turned out to be every eight days. He also mentions a man patient who obtained a fortnightly evacuation by taking a pill on alternate Saturday nights! Heberden reports a case with a monthly period, while another had twelve actions every day for thirty years, and afterwards seven in a day for seven years, in the meantime gaining in weight.[1]

Cumulative constipation is a variety recognized by Field in which there is an insufficient defecation. A case of this kind, recorded by Nothnagel, resulted in death from peritonitis following perforation of the colon by a large number of enormous stone-hard fecal masses, although the man never failed to have a daily evacuation. A patient of Ewald, whose bowels opened daily without symptoms, developed an abdominal tumor the size of a child's head low down in the abdomen. After medication with castor oil the tumor disappeared. Ewald also refers to a case reported by another observer, in which low-down abdominal pains and distention were relieved by the passage of an enormous and almost unbelievable quantity of fecal matter although the bowels had been "perfectly regular." Fragmentary evacuation, described

[1] Hurst.

by Boas, is a variety of this type. The feces are hard and dry owing to prolonged retention, dark in color and with little odor. The type is observed in some cases of colitis (discharge of mucus by the surface membrane of the colon).[1]

Hurst makes a striking generalization when he says delay in the passage through the intestines is due (a) to the *motor (muscular) activity of the intestines being deficient;* or, (b) the force required to carry the feces to the pelvic colon being excessive. Apart from organic obstruction the delay in either case is most frequently confined to the large intestine below the hepatic flexure (bend from ascending to transverse colon), this being the location where the intestinal contents begin to be more or less solid, so that additional force is required for their propulsion. Moreover, an increasing resistance is offered to the progress of the contents as they pass towards the pelvic colon, because the interior diameter of the cecum and ascending colon is much greater than that of the transverse colon. The latter diminishes in size as it approaches the splenic flexure (bend from transverse to descending colon), the diameter of the descending colon being smaller than that of any other part of the large intestine. Corresponding with the greater force required to carry the contents along the lower parts of the large intestine, the thickness of the muscular coat of the empty bowel is greater in the descending and pelvic colon than in the transverse colon, and greater in the latter than in the cecum and ascending colon. (Roith.) Under certain conditions, however, in spite of this compensatory mechanism, the muscular power of the lower colon is unable to perform its functions in an adequate manner.[1]

Internal secretions of some of the ductless glands when deficient, influence the motor activity of the intestines. Rolleston [2] confirms the observation of Hurst that extract of the thyroid gland given to women suffering from deficiency of thyroid gland secretion, may relieve their constipation; and extract of the pituitary gland, generally

[1] Hurst.
[2] *British Medical Journal,* 1910.

of cattle, under certain conditions acts as a powerful stimulant of intestinal movements.[1]

Lack of exercise, Hurst thinks, tends to produce constipation, and Kellogg strongly recommends also certain abdominal exercises (taken up later). Those who lead an active life require more food than those who lead a sedentary life, and the main addition to their diet is in carbohydrates (sugars, starches and cellulose—the fiber of vegetables) rather than proteins. Hence active people take a diet which stimulates intestinal movements much more than that taken by inactive people, who consequently tend to become constipated. Want of exercise weakens abdominal muscles *which largely control the voluntary part of defecation.*

Long continued irritation by purgatives (their effect is produced by irritating the intestinal membrane) with a consequent condition of catarrhal colitis (inflammation of the membrane of the colon) and the use of non-stimulating food leads to a lessened excitability of the intestinal mucous membrane.[2]

Astringents, most frequently in the shape of tea (China tea is the least harmful), exert a similar harmful influence on the intestinal mucous membrane. This constipating effect of tannin (an essential astringent element of tea) is frequent among the poor, who, in addition to eating fresh white bread, instead of whole wheat bread, and potatoes and bananas, that have little residue, instead of green vegetables and fruit, diminish the irritability of the intestinal mucous membrane. A cup of black coffee contains even more tannin than a cup of Ceylon tea. With the free addition of milk most of the tannin is rendered inert by combining with casein (the chief protein of milk which is used in cheese) and lactalbumin (milk albumin—the latter word derived from the Latin and meaning the white of egg).[2]

Hypochondria (morbid mental depression) sometimes superinduced by errors of diet, frequently results in a deficient secretion of intestinal juice, as all secretions tend to become diminished in quantity, so that large

[1] Hurst.
[2] Kellogg.

doses of pilocarpine often fail to produce sweating. One of the most interesting of such cases to be found is given by Hertz (since the war spelled Hurst) as follows: [1]

A medical man (note this fact) aged 45 asked Sir Arbuthnot Lane to remove his colon on account of constipation of several years' duration, his bowels being open only two or three times a week. Lane had Hurst examine him, as he doubted the wisdom of an operation. The patient looked healthy and had no abdominal pain or tenderness. He was extremely melancholy and said he had suffered ever since his student days from one abnormal condition after another, and he had spent half his life in undergoing cures of various descriptions; that he had had migraine (headache), gastritis (inflammation of the stomach), gastric ulcer, dysentery, mucous colitis (inflammation of mucous membrane of the colon), excess of uric acid (in the urine), renal colic (severe pains caused by any obstruction, frequently "stone," in the tubular canal leading from the kidney to the bladder), difficulty in passing water and irregularity and palpitation of the heart. He was in the habit of palpating (outlining by feeling and pressing with the palms of the hands and fingers) his abdomen, so that, although his abdominal muscles were quite strong, he could relax them to a remarkable extent, making the examination of his abdomen quite easy. He gave a very detailed description of the condition of his alimentary canal. His stomach, he said, was dilated and extended well below the umbilicus (navel); his transverse colon reached his pelvis (bottom of the abdomen); the interior diameter of his colon was normal up to a point two inches below the splenic flexure (see diagram), where there was a funnel-like narrowing leading to the lower part of the descending colon, the interior of which would barely admit the little finger; the sigmoid flexure (see diagram) had disappeared, and the narrow descending colon, coiled round, formed an accumulation similar in structure to the casting thrown up by earthworms.

The cecum and ascending colon were readily felt and appeared to be normal; the transverse colon could not

[1] "Archives of the Roentgen Ray" (x-ray), Vol. 13.

be felt, and the descending colon was found to be contracted, but not more so than is often the case when empty. The rectum was normal.

The patient had been strictly dieting himself for many months, but was now put on an ordinary mixed diet. His bowels had not been open for three days, so on March 31, six ounces of olive oil were injected per rectum and retained during the night. The next morning at 7 o'clock a soap enema was given with a good result.* At 8 a.m. 2 ounces of bismuth oxychloride were taken in bread and milk. (In his later practice Hurst has abandoned the bismuth for barium sulphate, on account of the weight of the bismuth.) At noon the cecum and part of the ascending colon were visible. At 4 p. m. the whole of the ascending colon could be seen. The next morning the near half of the transverse colon, normal in position, was clearly defined and the latter half only contained a little bismuth. April 3 the splenic flexure was reached and a little bismuth was seen in the descending colon. On the fourth morning the cecum, ascending colon, and commencement of the transverse colon were empty, whilst the last half of the latter and the whole of the descending colon were seen. The interior diameter of the latter was no smaller than that of the ascending and transverse colon, so that nothing like the stricture described by this medical patient was really present. The whole series of tracings could, in fact, quite well represent the passage of a bismuth meal through a normal colon if it went through in two days instead of four. A very dramatic incident of this examination, as the author in another publication explains, was permitting the patient, through a proper arrangement of the mirror, to make personal fluoroscopic observation of the functioning of his own intestines and thus effectually ridding his mind of the long persisting hallucination previously entertained by him.

The patient was given plenty of green vegetables and fruit. For a long time stimulating pills, *containing aloes*

* A good glycerine soap may prove efficient if it is decided to use soap, on which point there is a difference of opinion. Glycerine may have a desirable effect in such a use.

and nux vomica, were necessary. There seemed to have been no difficulty in achieving a complete recovery.

A similar case, also of a medical man, a professor in a prominent college, happened in this country recently. He became possessed of the idea that his colon was too long because it did not function as he thought it should. He applied to a surgeon for an operation, was refused, and then was operated on by a Cincinnati surgeon. The patient was dead in three days, although a man in apparently good health at the time of the operation and scarcely over middle age. It may be too charitable to say that the accommodating surgeon made a faulty diagnosis. But Richard C. Cabot has pointed out that in 3000 autopsies in the Massachusetts General Hospital in cases set down as death due to interstitial nephritis (inflammation of the kidney due to infection) over one-half showed no injury of the kidney.[1]

It sometimes happens that several members of a family suffer from infancy with constipation. Hurst says in some such cases this family tendency is the result of neglecting to educate the children in regular habits or of injudiciously dosing them with purgatives.[2]

Another kind of constipation occurs where people who have always been regular frequently become constipated as they approach old age. Stroup of Nancy, France, found that 23 per cent of 134 men and 39 per cent of 96 women over sixty years old suffered from this chronic condition, which is doubtless increased by the small quantity and bland character of the food often taken in old age and lack of outdoor exercise, which also tends to produce another tendency noted in elderly people of *incomplete defecation* when it does occur. Thus Stroup found fatty degeneration of the muscle-fibres of the abdominal muscles and the diaphragm (the muscular-membranous partition separating the lung-heart cavity from the abdomen) in each of seven autopsies on bodies over sixty years old.[2]

A marked lessening of the red coloring matter of the blood is often an associated condition. The case is cited

[1] *Journal American Medical Association* (1912).
[2] Hurst.

of a young woman, aged 21, admitted in July, 1907, who suffered from indigestion, absence of the menstrual flow, shortness of breath, swelling of the ankles and a feeling of irregular slackness, for five years. With the aid of purgatives the bowels had been opened three or four times a week. On admission the hemoglobin (the leading protein element of the red corpuscles of the blood) was 42 per cent of normal, but red corpuscles slightly in excess. She was given iron and arsenic with general improvement within a week. The hemoglobin rose to 55 per cent. On August 8th, the pills were discontinued in order that the seat of the delay might be ascertained. The cecum was reached 4½ hours after a bismuth breakfast, and the middle of the transverse colon 2 hours later. In the next 24 hours, however, an advance of only two or three inches was made, as the following morning the splenic flexure had not yet been reached, and in the afternoon the shadow was unaltered. Not until the second morning was the pelvic colon reached, the cecum being then no longer visible and the shadow of the ascending colon very faint. The trouble was thus found to be due to the sluggish action of the transverse colon beyond the middle.[1] (The treatment of such cases will be reached in later chapters.)

In fevers intestinal stasis is of frequent occurrence. Suggested causes are the bland character of the food and lessened amount of intestinal juice as a result of both diet and the fever, which impairs secretory activity. There may also be disturbance of bowel activity owing to the presence of poisons in the blood and the high temperature of the body.[1]

The involuntary exercise of function of the stomach and intestinal tract upon the entrance of food into the stomach causes the chyme (semi-fluid discharges from the stomach) accumulated in the terminal portion of the small intestine to pass into the colon. This effect is the most important stimulus to mass colon movements. These reflexes are most active when a proper quantity of food is taken. A certain amount of intestinal stasis is apt to occur when too little food is taken. The sight,

[1] Hurst.

smell, taste and idea of food when an individual is hungry stimulate the movements of the intestines. On the other hand when too little food is eaten because the patient has no appetite as is generally the case in neurasthenic individuals (suffering from nerve exhaustion, insomnia, intense nervous irritability, headache, feeling of constriction in the head, pain in the back, exhaustion after slight exertion, excessive sensibility to noises, irregular heart action, vertigo, dyspepsia), the effect of deficiency in the stomach, small intestine and colon must be particularly well marked. As bearing on the treatment of this class of cases the incident of a young man of 25 is cited. He had used purgatives all his life and was admitted to Guy's Hospital in September, 1908. It was found that his ordinary diet was of a very bland nature (lack of bulk) rarely containing green vegetables, fruit, brown bread or porridge. The patient was given a bismuth meal on one series of occasions while taking his ordinary diet, and on a second series, after five days, during which he had taken a diet containing porridge and molasses, brown bread, green vegetables, jam and fruit. The bowels were opened by an enema the day before the first series of observations was made; they were also slightly opened on the third morning. On three of the first five days when the stimulating diet was given, the bowels acted spontaneously, and they again acted on the second and third of the three days on which the x-ray observations were made. On the first diet more than six hours were required for the food to reach the beginning of the colon at the cecum; on the second, traces had reached it in four hours. In ten hours the hepatic flexure (bend from ascending to tranverse colon) was reached with the regular diet, but with the stimulating diet the splenic flexure (between the transverse and descending colon), a point rarely passed in this period in any normal individual. In 28 hours a similar difference was observed, the bismuth having reached the pelvic colon with the stimulating diet instead of the end of the transverse colon. In 52 hours a good part of the bismuth was still present in the colon with the first diet, but only traces remained of the other. Thus the diet rich in cellulose

and sugar had the effect of hastening the passage of the intestinal contents through both the small and large intestines. At the same time it probably produced a more abundant intestinal secretion and allowed a larger growth of benign bacteria in the colon. Consequently sufficient residue was now present in the pelvic colon each morning to form a daily output of normal size. When last seen, about four years later, he said his bowels had opened almost every day.[1]

[1] Same.

Chapter IX

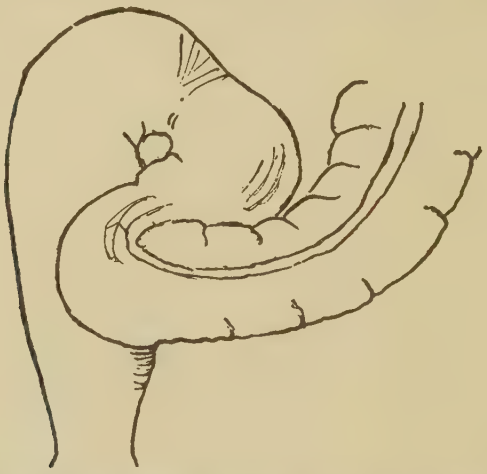
SPASTIC CONSTIPATION (CONSTRICTION OF THE COLON)

Spasticity in the sense used here is spasmodic contraction of the large bowel, acute or chronic. Patients suffering from this condition are generally thin, more or less neurotic (nervous) individuals, many being definitely neurasthenic (lack of nerve balance or tone) and a few hypochondriacal (melancholic).[1]

There is always a long history of the condition which often becomes more obstinate in attacks which may recur for many years and last, with short intermissions, for a few days or a few months. Attacks are frequently brought on by overwork, worry and sometimes by a definite shock. They are often relieved by occupying the mind, so that mild exercise, if it is of a congenial nature, generally produces relief. Strenuous exercise tends to aggravate the condition. Aperients invariably cause pain and are often quite ineffective. The feces are hard, dry and small; they are often coated with mucus as a result of secondary inflammation of the interior surface of the colon. They may be quite flat or narrowed to the diameter of a pencil but more often small, round scybala are passed (small, hard masses). The former type, which was regarded by Fleiner as the distinguishing characteristic of spastic constipation, is produced by spasm of the anal sphincter and not by spasm of the colon, as material molded into thin forms higher in the intestines tends to be agglomerated into larger masses in the rectum. If sufficiently soft they may again be moulded into thin strips on their passage through the contracted anal canal. Successful defecation is often

[1] Hurst.

painful, as the spasm of the colon is generally accompanied by spasm of the anal sphincter. The spasm at the pelvi-rectal flexure (sigmoid or S-shaped bend of the colon immediately behind the rectum—the lowest section of the bowel) also obstructs the entry of an enema into the colon; when fluid has been introduced by pres-



Terminal coil of the sigmoid flexure (within the pelvic cavity) connecting the descending colon and rectum. (After Gant.)

sure it is often retained in spite of every effort to evacuate it.[1]

There is often dull ache in the abdomen which does not amount to actual pain but may be wearing on account of its long duration. Sometimes the attacks of severer constipation are accompanied by more or less pain. This is often situated in the left or right pelvic region and occasionally it moves from side to side or is central. Some rigidity of the abdominal muscles is often present. When the pain is situated on the left side the whole of the descending and pelvic colon, or the latter alone, can be felt as a thin, hard and tender cord, which is sometimes retracted upon a row of small

[1] Same.

round, hard fecal masses. In some cases the contracted pelvic colon can be felt by pressing deeply above the pubes (central, frontal bony foundation of the abdomen). When the pain is in the right side, the ascending colon is sometimes felt as a similar but rather thicker cord in the flank, the cecum being distended with soft material or gas. The transverse colon can rarely be felt but occasionally the whole colon is palpable.[1]

The condition of the colon in spastic constipation has been investigated by Singer and Holzknecht with x-rays. Their conclusions coincide with those of Hurst, that feces generally pass along the first part of the colon either at the normal rate or more frequently at an abnormally rapid rate, delay only occurring in the part beyond the splenic flexure (see diagram) or at the pelvirectal flexure (sigmoid). The contracted part of the bowel generally begins at some point between the hepatic flexure (see diagram) and the end of the descending colon, the pelvic colon being most often affected. By observing the colon after a barium enema in spastic constipation Singer and Holzknecht found that the last part, in which delay occurs, has a diameter one-quarter or one-half smaller than normal.[1]

The obstruction is not of a mechanical nature, as the x-rays show that there is generally no delay in the passage through the contracted segment. The colon immediately above is often not dilated, though the cecum (see diagram) is frequently distended with gas and visible and palpable peristalsis is never present. Moreover Boas has shown that the spasm can easily be overcome by inflation of the colon with air and water but it returns as soon as they are passed. He has also pointed out that the contracted colon can often be felt for several weeks after treatment has led to complete disappearance of the constipation. The actual cause of the disorder appears to be the absence of normal, orderly, propulsive activity of the intestine, which is replaced by irregular, spasmodic contractions of some parts while others remain almost completely inactive, defecation

[1] Hurst.

being also rendered difficult by the spasm of the pelvirectal flexure (sigmoid) and the anal sphincters.[1]

As spasticity of the colon is a not infrequent form of constipation the following interesting case is given in detail by Hurst:

William K., a highly neurotic (nervous) man of 48 had done much hard work as a farmer in Australia with poor living and financial anxiety. He complained of abdominal pain, which came on in paroxysms lasting for a half hour or more. Attacks were aggravated by exercise. The pain occurred in different parts of the abdomen. It was occasionally brought on by meals, but the chief variations corresponded with the severity of the constipation, from which the patient habitually suffered and from which relief was obtained by purgatives. Defecation was generally followed by pain. Vomiting occurred occasionally and the patient lost 28 pounds in the 5½ years since his illness began. Immediately after eating he sometimes experienced suffocation attacks, also neuralgic pains in the head and irritability of the scalp and feet.

On examination he was found to be thin but fairly muscular. Abdomen somewhat retracted with considerable rigidity but with very little tenderness. Rectum empty and normal. The patient was very pessimistic and much worried about himself.

The long history, the mental condition of the patient, the paroxysmal nature of the attacks and their association with constipation led to a diagnosis of enterospasm (increased, irregular and painful peristalsis—spastic constipation). The patient was given belladonna and codein and his bowels were kept open by olive-oil injections, as purgatives had no effect beyond causing great pain. Though the constipation was relieved by the oil enemata the pain could only be controlled by keeping the patient in bed on a milk diet. Increase in the diet or a short time out of bed was always followed by a severe attack. These began even when the patient was interested in a book or engaged in an exciting game of chess, so that I began to doubt the nervous origin of the attacks. This

[1] Same.

doubt became stronger when, at the end of the first month, a small horizontal tumor could be felt just above and to the right of the navel in the situation where most pain was now experienced. An exploratory operation developed that the apparent tumor was a tightly contracted transverse colon.

When constipation is associated with intestinal spasm it is often necessary to begin the treatment with a period of rest. The patient should go to bed early and it is advisable at first to have breakfast in bed, allowing the patient to get up only in the middle of the morning. In severe cases, especially when loss of appetite and emaciation are present, the patient should remain in bed from two to four weeks, but should get up each morning in order to open the bowels. If enough food is given, the rest often results in rapid recovery from the constipation without any local treatment, although hydrotherapy (water applications, external or internal) massage and electricity, which should all be given in a mild form, often hasten improvement. In uncomplicated cases belladonna is the most useful drug for combating spasm, dose ½ to 2 grains,[1] but in many cases very small doses of bromide should also be given to diminish the irritable condition of the nervous system.[2] When the pain is severe it may be necessary to add codein[3] to the belladonna. The self-centered state of the patient's mind should be discouraged. Irrigation should be by normal saline solution (see index) only when necessary; and injections of soap and water, antiseptics and astringents avoided.[4]

Spastic constipation is made worse rather than better unless any pressure is extremely gentle. Ordinary mas-

[1] Belladonna increases peristalsis and diminishes any tendency to spasm in the muscular coats of the intestine—Hare ("Practical Therapeutics"). There are several preparations. The dose for the tincture is 5 to 15 minims (drops) 1/60 of a dram. A dram is supposed to be a moderate-sized teaspoonful. Experiment shows the moderate sized hotel teaspoon holds 50 drops of water.

[2] There are several bromides. Sodium bromide can be had in 5 grain tablets. Dose 10 to 30 grains. (Hare.)

[3] Derived from opium. Dose 1 to 2 grains. (Hare.) Not recommended for self-administration except in an emergency.

[4] Hurst.

sage can, however, be applied to all parts of the colon, such as the cecum, which shows lack of tone and is not abnormally contracted, but it should never be employed if there is any evidence of serious inflammatory symptoms.[1]

[1] Hurst.

Chapter X

THE COMMONEST FORM OF STASIS

As the intestinal contents pass downward they carry with them the flora (micro-organic plant life) from a higher level, but if the conditions are not favorable for their growth they quickly give way to more adapted types. In the lower part of the colon, due to the gradual loss of water, there is a marked decrease in the number of live micro-organisms and those that remain are incapable of further growth. It is estimated that from 5 to 8 drams of bacteria, mostly dead, are excreted each day,[1] (8 to an apothecary's ounce).

Dyschesia is a derangement of the functions of the *lower end* of the great bowel. It is the most common of all forms of constipation, the most ordinary effect being imperfect action. Hence, although the bowels may be opened daily the contents become unduly hard owing to the excessive absorption of water during their long retention. In severe cases defecation is not only incomplete but it does not occur daily and finally it may become quite impossible for the bowel to function without mechanical assistance. The pelvic colon can often be felt through the front wall of the rectum to be filled and in some cases a further accumulation is found by abdominal palpation (with finger tips) in the iliac (left flank) and even in the descending colon (above). Occasionally the dyschezia is due to inability to pass the contents of the pelvic colon into the rectum, the evacuation from the latter offering no difficulty. In such cases the rectum is found to be empty; but the impacted contents in the pelvic colon can generally be felt as an

[1] "Pathogenic Micro-organisms," Park and Williams (Lea and Febiger).

elongated tumor through the front wall of the rectum. As a similar accumulation may occur in the rare but important cases where the slowing up begins farther back in the colon, the question as to which of the two forms is present can only be answered by the x-rays.[1]

As the activity of the colon as far as the splenic flexure (bend from transverse to descending colon) and below in uncomplicated cases of dyschezia is normal (an important point to note) treatment by diet and purgatives is always ineffective because they expend their force in the upper part of the bowel which is functioning properly.[1]

Chevalier,[2] was the first to describe this type of stasis and explained how enemata are the only proper treatment, as with purgatives "the whole intestinal canal is teased and pained for the defective action of that very part of it which is remote from their influence."

The causes of dyschezia are not far to seek. When the lower end of the bowel is filled to the point of impaction the muscular coat becomes more and more relaxed, distended and weakened to the point where it loses the power to contract against the dry and semi-solid mass that requires expulsion. In some cases the impaction extends to the pelvic colon, in consequence of which its muscular coat undergoes similar changes. The desire is lost so that the patient has succeeded in completely deranging nature's very important functions for the colon discharge of the refuse of the body. In extreme cases the blunting of the muscle sense may develop to the point where the introduction of the enema may not produce even an artificial call to defecation.[1]

This call is habitually disregarded for various reasons, the most frequent of which are *ignorance* and *laziness*. Regularity of this habit should be taught with the greatest care from early infancy. Surgeon-Colonel J. G. Pilcher of the British occupation forces in India reports that the rarity of constipation among the natives of India is largely due to the fact that the habit of defecating at an early hour in the morning is universally taught. The Indian mother supports the buttocks of her infant on

[1] Hurst.
[2] In *Medico-Chirurgical Transactions*, X, 400.

the mother's big toes, so that it can defecate between her feet. As soon as the child can walk it accompanies its mother to the jungle at or before sunrise. The result of this teaching is seen in the Indian prisons. The moment the dormitories are open at sunrise every prisoner rushes to the latrine, and by 8 a. m. the whole proceeding for 2,000 persons is ended and the material removed and trenched in the prison garden. Constipation is also unknown among children in China and Japan owing to the excellent training infants undergo from birth. When it wakes in the morning the mother supports its buttocks in her hands and holds it erect with its back firmly against her breast in which position she presses its thighs against its abdomen.[1]

Hurst gives a typical case of dyschezia. Mabel T., aged 17, had suffered from dyschezia since she was 10 years old. As a little girl she had no time to attend to this call of nature before going to school, and when there she was too shy to ask for permission to retire. At 15, when she began work as a dressmaker she had become very constipated, but with the aid of medicine kept her bowels open every other day. Unfortunately the desire came in the morning, when it did come, while she was at work. If she retired she required so much time that it became a subject of remark so that she no longer obeyed the call. This gradually became weaker and the difficulties increased. She now attended to this duty but twice a week. She was occasionally sick, her appetite was poor and she always felt slack and unequal to doing any work. The troubles reached a crisis in February, 1907, when she was admitted to Guy's Hospital after a period of bowel inaction lasting five weeks. Her abdomen was somewhat distended and tender, her tongue dry and furred and she vomited occasionally. She was given an enema at once and various purgatives tried but the bowels were only opened when an enema was given. After her discharge she was treated with electrical massage but with no improvement, so on May 24 she was readmitted. She complained of pain in the abdomen, she was occasionally sick, had a poor

[1] Hurst.

appetite, her complexion was sallow and her expression apathetic. Her bowels were opened by enema May 25. After this she was given a full diet but no medicine. Her bowels were not opened again until May 28. On May 27, 1907, she was given a bismuth breakfast, this being the first occasion on which a case of constipation was ever examined with the x-rays. In four hours the shadow of the cecum and the whole ascending colon was distinctly visible on the fluorescent screen (fluoroscope). Ten hours after the breakfast the shadow of the large intestine from the cecum to the end of the iliac colon (sigmoid flexure) was visible. The next morning after 28 hours, it had all accumulated in the greatly distended pelvic colon and rectum, except a small quantity which was still present in the ascending colon. Thus the passage through the small intestine and colon was rapid rather than slow. On the afternoon of May 28, the day after the bismuth meal was taken, the rectum was found to be dilated and completely filled with hard feces, but there was no inclination to defecate and she was unable to do so. The contents were broken up and an enema given when a large quantity was evacuated which greatly relieved the abdominal pain. The next morning another enema was given but with a less result than on the preceding evening. No trace of the bismuth could now be seen, showing that the enemata had removed all the bismuth from the colon.

The patient's condition must have been due to paresis (partial paralysis) of the muscles of the pelvic colon and rectum, brought about by their over-distension, as the remainder of the colon was normal, the diaphragm moved well and the abdominal muscles were moderately strong. The patient was thus suffering from dyschezia. The rapid passage through the small intestine and colon was analogous to that occurring with an organic obstruction, being due to the increased activity of the bowel in its attempt to overcome the obstruction in the pelvic colon and rectum. After May 29 an enema was given every day to June 11. In 4 hours after a bismuth breakfast the cecum and a small part of the ascending colon were seen through the fluorescent screen and 4½ hours

later the cecum, ascending colon, and most of the transverse colon were visible. The next morning no enema was given, and at 11 a. m. most of the large intestine from the cecum to the beginning of the pelvic colon could be seen. At 5 p. m. the pelvic colon was also visible, and was found to be no longer distended. On June 13, at 6 a. m., 48 hours after the bismuth breakfast, an enema was given with a good result. At 10 a. m. no bismuth shadow was visible. These observations showed that the pelvic colon was no longer distended and that with the removal of the obstruction, the stimulus to increased activity of the colon had gone, as the bismuth no longer passed at an abnormally rapid rate through the intestines.

The patient was now almost completely free from pain and looked and felt much better than she had done for many months. An attempt was made to hasten the recovery of the tone of the pelvic colon and rectum by means of intra-rectal electrical treatment. This had no appreciable effect and was discontinued after ten days. The patient was then discharged and her mother instructed as to proper diet and asked to encourage her to try and open the bowels every day without artificial assistance. If she failed an enema was to be given.

The patient was seen at intervals until 1912. She looked and felt much better though she was still quite unable to escape the use of the enema. This had only failed to act on a few occasions. Thus on April 19, 1908, she came to the hospital to say that her bowels had not been open for 24 days. In spite of this she did not look ill, but she complained of considerable abdominal pain and tenderness. The rectum was found to be greatly distended but nothing could be felt in the descending or iliac colon. She was accordingly readmitted. Six ounces of olive oil were injected in the evening and retained during the night. The next morning an enema higher than usual produced a large evacuation. The following morning an ordinary enema was found to be equally effective. It seems probable that this attack was due to the inefficient administration of the enema at home.

The reader should note here that the main reliance in this severe case of dyschezia was on the enema. Nothing else was done that succeeded in lessening the formidable character of the obstruction with which the physician had to deal.

Chapter XI

THE GREEDY COLON

Goodhart of London, consulting physician to Guy's Hospital, first used the phrase "greedy colon." In a lecture delivered in 1902[1] he made this observation: "I have no doubt in my own mind that this absorbing organ (the colon) is much more active in some than in others and that when greedy the colon, by rejecting so little, is a cause of constipation." This Goodhart theory has grown in importance because, if correct, it explains the presence of dry impacted feces in so many cases.

Hurst remarks the unusually complete digestion of food in some cases as being particularly noticeable when articles of diet containing large proportions of cellulose, such as raw vegetables, raw fruit and mushrooms are consumed. In normal individuals they are only digested to a slight extent, but in cases of greedy colons they are more or less completely absorbed, the intestines appearing to possess the power of digesting a considerable quantity of cellulose and even of the semi-cellulose of agar. According to Adolf Schmidt, quoted by Hurst, the stools of the greedy colon are strikingly different from the dry, hard stools which are passed as a result of taking opium and from patients suffering from dyschezia (in the lower part of the colon), as these contain obvious vegetable refuse and are of normal constitution, except for the small quantity of water present. This, however, only shows that very little digestion can take place in the rectum, as the constipating action of opium appears to be chiefly due to a diminution in rectal sensibility with the consequent development of dyschezia. Frequently

[1] Lancet, 1902.

the greedy habit of the colon is acquired, as in the following case, cited by Hurst:

Margery W., a governess, 23 years old, was admitted into Guy's Hospital under Dr. Newton Pitt in November, 1908, for severe constipation following an attack of diphtheritic paralysis when she was 18. For five years she had no desire to defecate and had never opened the bowels oftener than once in five days in spite of the daily use of cascara sagrada. The stools were semi-fluid. Though she felt tired and subject to headaches she was well nourished and her color was good. On admission her tongue was furred and her breath offensive. The rectum was completely empty and no accumulation could be felt in the colon, although the bowels had scarcely been opened at all for more than three weeks. Purgatives were ineffective and enemata never brought away more than a very small quantity of material.

The x-rays showed that the passage through the intestines was at the normal rate. This agreed with the patient's history, that her bowels rarely opened oftener than once in five days and that then only a small quantity was passed. It was clear, therefore, that she had an exceedingly greedy colon, absorption being so active that by the time the pelvic colon was reached hardly any residue was left. The proportion of bacteria in the feces was found to be about normal. This view explains the complete failure of purgatives, as they merely hastened the passage of the small quantity of contents, which already moved with sufficient rapidity.

The patient was given three drams of a mixture (principally agar) every day, in order to increase the bulk, for ten days without appreciable effect. Two days after the regulin was discontinued the patient's mouth temperature suddenly rose at 2.30 p. m. to 110° and she felt extremely ill. She was sponged and it fell to 101° but rose again to 111.4° at 5.30. At 6.15 it had fallen to 97.6°. At 8 p. m. it again rose for a few minutes to 104.° It remained normal until the next morning, when it rose in a half hour to 108° from which it fell in a few minutes to normal and did not rise again. The theory advanced by Dr. Pitt, in charge, was that the agar with the intes-

tinal juice formed an unusually good culture-medium for intestinal bacteria and that the high temperature was due to intestinal poisoning. After a month the amount of feces passed each week with the aid of enemata, but without regulin, amounted in quantity to but a normal stool. Examination of the results of the enemata showed that during a first period of 12 days she passed 4.3 grams of dried feces (1 gram = about 15½ grains, about 31 grams to an ounce) or 0.36 grams per diem, and during a second period of 8 days 5.1 grams, or 0.64 grams per diem. During the next 3 days she took 12 grams of agar a day, but only passed 3.9 grams, or 1.3 grams a day. On the diet she was taking a normal individual would pass about 40 grams of dried feces a day.

Several months after the patient left the hospital she improved somewhat and for several months had a small passage every two or three days. In 1914 she had a course of treatment with diathermy (local rise of temperature produced by a form of high-frequency electric current *) which did her good for a time. In 1915, after an accident to her arm, she began to pass blood and mucus and her constipation became worse. In November, Sir Arbuthnot Lane removed part of her colon. She did very well until February, 1916, when severe pain and sickness developed. A second operation was performed, several adhesions (bands attached probably to colon) divided and some small glands removed. For two months she had septic trouble in her throat, gums and breasts, but from August (until she was heard from last in November, 1917) she was very well, indeed. Her bowels acted daily, she had no pain and felt better than she had done for years, being able to do light duty in the nursing home where she had lived since her first operation.

* The modern high frequency current is alternating, having from 100,000 to some millions of alterations per second. It is produced by a condenser discharge modified by various coils and is a specific for diseases characterized by an inflammatory exudate, such as pneumonia; also in high blood pressure where it finally brings the mercury column down from the region of say 200 to the region of about 138.—Communication from Dr. Sinclair Tousey, New York City, author of "Medical Electricity."

The good result in this operation needs to be supplemented by our author's opinion, expressed elsewhere, on the general subject of colon surgery: "When constipation is the result of definite organic obstruction, surgical treatment is clearly indicated. But various operations have been recommended in the last ten years for the relief of constipation in the absence of this clear indication, and the results obtained have only been satisfactory in a comparatively small proportion of cases. Though I have sometimes seen extremely gratifying results follow the surgical treatment of constipation, it has, to my knowledge, been the direct cause of deaths in several cases, and I have been consulted by patients whose condition afterwards was either no better or actually worse."

One of the best authorities in this country says that in bringing forward (in a notable book on surgery) the subject of displaced abdominal organs and stasis we are opening one of the most dangerous fields for surgical abuses at the hands of the surgical "confidence man" who needs no other excuse for performing a surgical operation than the consent of the patient. X-ray observation is of inestimable value in the study of these cases, but the most dangerous agent yet placed at the disposal of the unscrupulous surgeon, because it is so convincing to the patient and at the same time so meaningless when considered independently of the history of the case and not properly interpreted. This warning is necessary because there are more people afflicted with such defects than with any other disease known to humankind, the percentage reaching to fully one person in five of potential sufferers from abdominal organs displaced downward.[1]

Dr. Charles H. Mayo, the noted surgeon of Rochester, Minnesota, in an address in Cincinnati in 1923, as reported in the press, registered his opposition to the much too frequent use of the knife by surgeons. He pointed out that the body is weakened by operations and they

[1] Robert C. Coffee, Surgeon-in-chief Portland Surgical Hospital, author of "Gastro-Enteroptosis," Appleton (1923), the leading book of its class. Reputable physicians are not here alluded to.

should never be resorted to except in cases of absolute necessity.

Everyone knows, says a distinguished English authority and surgeon, the frequency of displaced abdominal organs, of loose kidneys, of the flaccid mid-section of the abdomen (epigastrium) and bulging below. Consti-

Dr. Robert C. Coffee designates the accompanying cut as a typical ptotic figure (indicating the falling of the intestines) after Martin, from a drawing in Richard Smith's collection. "Picture shows flat chest, straight back and cannon ball abdomen." Surgical Monographs (Appleton, 1923).

In such cases, to prevent the over stretching of the muscles, says Hurst, abdominal support is required when they will generally regain much of their former strength. In mild cases women should use a special straight-fronted corset that does not constrict at the waist but supports the lower abdomen; put on when lying down. The foot of the bed slightly raised adds to the comfort of the patient. (See footnote p. 189).

pation seems a heritage of every race. Here is material in abundance for the surgical adventurer. Regardless of all else the stomach may be lifted and fixed by suture (stitches), the kidney anchored to the last rib, and constipation relieved for the moment by a short-circuiting or abstracting operation (cutting out by the surgeon). The lot of patients is hard. Constipation will soon return, the other kidney will fall down or the anchored one break loose, and the distress of the stomach greatly exceed that of its vagrant days. That is the tale of reck-

less surgery. There are few subjects in medicine so greatly in need of the best services that pathologists (who deal with the nature of disease), physicians and surgeons alike can give.[1]

The investigation of the case just reported in detail shows that the constipation of patients with a greedy colon may be simply the result of excessive digestion and diminished residue. The normal action of the intestinal tract since her colon was removed showed, in the opinion of Hurst, that it was responsible for the excessive absorption and that the small intestine continued to act normally.

This form of stasis is frequently associated with excessive acidity of the stomach. In a series of 100 cases of habitual constipation, taken from the records without any attempts at selection, 87 showed increased gastric acidity. On the other hand in diarrhea analysis of the stomach contents regularly showed decreased acidity. Strasburger[2] believes that the strong disinfectant influence of the increased hydrochloric acid (an important constituent of the gastric juice) causes increased digestion, with smaller food residue, and sterilization of the food, thereby diminishing the growth of bacteria with absence of putrefactive odors and lessened bowel movement with consequent constipation. Microscopic examination usually discloses the residue to be mostly detritus (fragments).[3]

Russell divides practically all forms of gastric disorders into two classes—excessive and deficient hydrochloric acid—a very important observation.[4]

Reverting to the subject of this chapter the reader should note that excessive colon digestion or absorption can be of many degrees of development. In a large percentage of cases, especially where the trouble is in its early stages, the facts cited are of great importance because it is then that a cure or amelioration can be

[1] Sir Berkeley Moynihan.
[2] J. Strasburger, Director of the section of Hydrotherapy (water cure) of the Medical clinic of the University of Bonn (Germany).
[3] Hurst.
[4] Wm. Russell, ex-president of the Royal College of Physicians, Edinburgh (Scotland), in "Stomach and Abdomen" (1922).

most easily effected. The subject is an interesting one as showing a probable explanation of a series of puzzling conditions present in many cases of constipation. Strasburger prints the following table showing in grams the colon output of six individuals, three normal and three constipated, *all kept on the same diet:*

	Normal	Constipated
Weight of feces per diem	107 grams	60 grams
Dried	23 "	16 "
Nitrogen	3.0 "	1.5 "
Fat	13.8 "	8.4 "
Carbohydrate	1.8 "	1.4 "
Cellulose	0.08 "	0.02 "
Dry Bacteria	8 "	6 "

1 gram = nearly 15½ grains, 480 grains to the ounce.

Thus each of the three chief constituents (food-residue, moisture and bacteria) is diminished in constipation.

As diminished residue is a condition in nearly all forms of intestinal stasis the reflecting reader will note the manifest importance of avoiding such an unnatural disposition of the material by absorption.

Chapter XII

POOR APPETITE A CAUSE

A poor appetite is a common cause of constipation. It is an almost constant symptom of neurasthenia (a group of symptoms resulting from debility or exhaustion of nerve centers) so that an insufficient quantity of food is generally an important factor in the stasis which is so frequently present in this condition. The patient diets himself because he thinks the dyspepsia, which is often present, is a cause instead of an effect. He gives up one thing after another without obtaining relief. This voluntary starvation, in which the quantity of food taken is only gradually reduced, always results in a corresponding diminution of appetite. The patient subsists on extremely small quantities of food without experiencing any desire for more. As a result the body weight diminishes considerably until a point is reached where the reduced weight and the intake of food balance each other, the metabolism (conversion of foodstuffs into tissue elements) being now on a very low plane. "It is no exaggeration to say that the number of women who are ill because they eat too little is as great as the number of men who are ill because they eat too much." [1]

A case set out in detail by Hurst is of a man of 35 who reached the conclusion that there must be something seriously wrong with his intestines to produce such insufficient motions. He consequently decreased the amount of food, eating mostly gruels—precisely the wrong thing—with the natural result that he lost weight and became weaker. The cause of the condition, which had become progressively severer, was clear enough. His food was so insufficient in quantity and so unirritating

[1] Hurst.

in quality that the stimulus to bowel movement and to intestinal secretion became very feeble, and the size of the stools very small. On examination, although the patient's bowels had not been opened for several days, the rectum was found empty and the descending and iliac colon contracted, there being clearly no fecal accumulation in spite of the apparently insufficient amount of bowel action. The patient was told there was no cause for worry, as he had no organic disease, and his condition was easily curable. He was directed to eat a proper amount of mixed diet. No drugs were given. When seen in February, 1909, he had put on weight and all his abdominal symptoms had disappeared.

The underlying error in the above case was the same as in Fletcherism. Horace Fletcher died prematurely in Copenhagen of bronchitis. The underlying cause was believed by a prominent American physician, who treated him, to be intestinal intoxication.* One of his favorite self-felicitations was that by chewing the food into a condition of fluidity, the bowel refuse was so small that defecation need not be performed oftener than once in several days. He is believed to have left the most important element, putrefaction, out of account.

* Personal communication to the authors from an authoritative source.

Chapter XIII

STARTLING THEORIES OF SELF-POISONING

The word auto-intoxication has come to mean in late popular sense a self-poisoning or infection of the body from a disease focus within the large intestine arising in putrefying material. As a matter of fact the word is wrongly used as it really applies to any secondary infection, whatever the primary source within the body. The theory of the infection of the body from the large bowel (intestinal intoxication or infection) has taken root and flourished amazingly although there are a few authorities who have accepted it with certain qualifications.

Sir Arbuthnot Lane, the eminent abdominal surgeon of London, has been in a position for many years of making interesting first-hand observations on this important subject and probably no authority can be quoted who gives more vigorous support to the theory.

The first result of intestinal-intoxication, he says, in his book *Intestinal Stasis*[1] is the decrease of fat (loss of weight), which is a marked feature in most cases and is, perhaps, the first evidence that the individual is failing to deal with the poisonous matter that is destroying the structure and impairing the function of every one of the tissues of the body. The removal of the pelvic fat results usually in a backward displacement of the fundus of the uterus. Intestinal intoxication plays so large a part in the development of diseases of the female genito-urinary organs that many specialists in those diseases believe that these pelvic conditions may be a product of intestinal stasis.

As regards the attractiveness of woman, the loss of fat is a matter of vital importance to her happiness.

[1] 3d edition, 1918.

The skin undergoes remarkable changes in the formation of wrinkles, the prominence of bones, flatness and flaccidity of the buttocks, droopiness of the breasts, and increasing pigmentations (discoloration). The neck becomes brown, later almost chocolate colored. The skin of the armpits, abdomen, adjacent aspects of the thighs and the covering processes of the spine become darker and darker. The secretions of the flexures of the colon become abundant and offensive. The hair becomes dry, is rapidly lost either because of impaired nutrition of the cells or from the invasion of the roots by microorganisms. In the young subject there is often a new growth of fine hair over the lower part of the face, down the back and over the forearms. These all disappear more or less completely with an improvement of the conditions.[1]

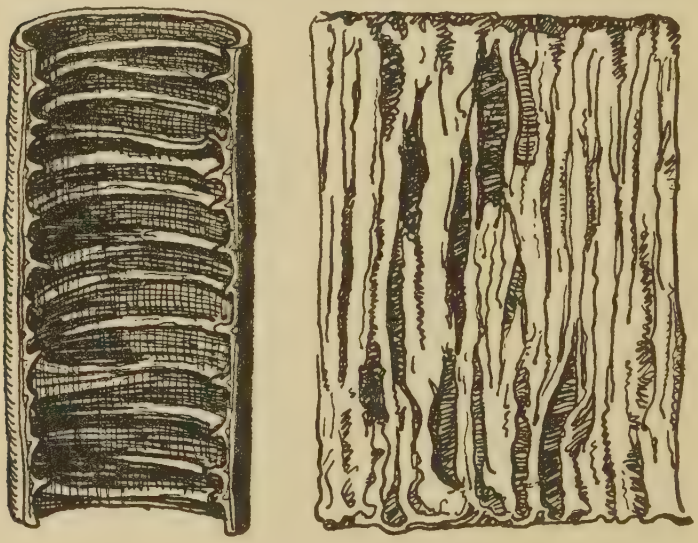
The muscular system degenerates in a marked manner, the voluntary muscles wasting and tearing easily. In consequence the individual frequently assumes positions of rest. The relaxation of the muscle wall of the abdomen *deprives it of its function of compressing the viscera efficiently in defecation* with the result of a large accumulation in the pelvic colon. The muscular wall of the intestine wastes in a similar manner. The large intestine has no rounded form but, being inelastic, puddles in the floor of the true pelvis, forming innumerable bends through which its contents are advanced with great difficulty. In one group of cases the heart is soft and flabby with blood pressure subnormal; while in another the left heart is definitely enlarged, the aorta (the large artery of the heart) dilated and its walls weakened by fatty degeneration as are those of all the vessels, and the blood pressure is abnormally high. In the cases of the syphilitic individual (sex disease) these changes become more marked when associated with intestinal intoxication. Inflammatory or degenerative changes in the kidneys are much more commonly associated with the second group (high blood pressure) than with the first.[1]

The toxins (poisons) appear to exert a specially depreciating influence on the respiratory center. Symptoms

[1] Same.

which are typically asthmatic in character are not infrequently seen in this condition, while minor varieties are commonly present.[1]

Perhaps the worst feature of chronic intestinal stasis is the distressing and depressing effects on the nervous system. Sometimes the depression and melancholia are



A B

Folds of the mucous membrane of the small intestine, running transversely for about two-thirds of the circumference. A. A piece of the jejunum (second portion) which has been filled with alcohol and hardened. B. A section of fresh intestine spread out under water. (After A. Birmingham and Cunningham's *Text Book of Anatomy*.) In cut B the lines run lengthwise of the intestine.

so great as to lead to fear of suicide. Familiar symptoms are headache, sleeplessness and inability to perform any mental or physical exertion. The favorite diagnosis for these cases of intestinal infection is neurasthenia (nerve weakness). So-called neuritis (disease of the nerves) is a frequent complication. It varies commonly

[1] Same.

in severity from violent neuralgic twitching, resembling epilepsy, to sciatica (neuralgia of the sciatic nerve felt at the back of the thigh and sometimes running down the calf of the leg) of a mild type. Often the pains are described as rheumatic.[1]

At first in females the breast presents characteristic hardening which commences in the upper and outer zone of the left breast, subsequently extending entirely over both. Cystic or other degenerative changes may ensue and at a later period cancer may appear with remarkable frequency in these damaged organs. The author has found as many as seven distinct nodules of possible cancer in a hard, lumpy breast in which the presence of that disease was not suspected. One of the most remarkable results of removing the source of intestinal infection is the rapidity with which even extreme degrees of degeneration of the breast disappear and the organ regains its normal form and texture after operation on the intestine.* That the skin, lessened in vitality and resisting power, becomes invaded by various organisms that produce many of the skin diseases, is familiar to us all. The most common affection perhaps is the formation of pimples on the face and body.[1]

The presence of tubercle in the body, except by direct inoculation, is believed by Lane to be always preceded by intestinal infection. Where the intestine is involved the disease commences at the termination of the ileum (end of the small intestine). It manifests itself in the angle between the ileum and cecum, or it may have, associated with glandular enlargement, a number of ulcers extending upward at intervals along the small intestine. Associated with this intestinal infection, or independently of it, tubercle may be present in the median space dividing the right and left lung cavities. Tubercular infection is, unfortunately, frequently not a pure infection, but is aided in its destructive power by a variety of other organisms.[1]

Chronic articular rheumatism, like tubercle, is never

[1] Lane.

* See p. 64, Cabot says non-cancerous lumps in younger women should be removed as about ten per cent. have been found to become cancerous —Layman's *Handbook of Medicine.*

present except in association with intestinal intoxication. Its severity may be accentuated by the presence of any other infection which exists in consequence of the stasis, such as infection of the uterus, gums, nasal and associated membranes, etc., and some relief may be obtained by dealing with these secondary infections.[1]

The thyroid (a large, ductless gland at the lower part of the neck, an enlargement of which is caller goiter), is liable to various infections which cause the several forms of disease of that organ, such as exophthalmic goiter (characterized by palpitation of the heart), general hypertrophy (enlargement), the development of outside tumors, of cysts (a cavity containing fluid and surrounded by a capsule or membrane) and finally cancer. "None of these conditions can arise except in the presence of intestinal intoxication."[1]

To the list of diseases traceable by Lane to intestinal infection, based on his surgical experience, Kellogg, also a surgeon of wide experience, adds a still more formidable list.[2] He asserts that "poisons that cause the rise of blood pressure are produced in the intestines. Bain found these poisons present in the blood of persons who have high blood pressure, showing that they are retained in the body."

These poisons have been shown by experiment to be capable of producing nephritis (disease of the kidneys) when absorbed from the mucous membrane as well as when injected.[2]

Mantle agreed with Sir Bertrand Dawson that inflammation of the mucous membrane of the colon as well as inflammation of the stomach and catarrh of the upper section of the small intestine may be due to infection

[1] Same.

[2] John Harvey Kellogg, born in Michigan, 1852; a graduate of Bellevue Hospital Medical College (N. Y.), 1875; studied in Europe for six different periods. 1883-1911; supt. and surgeon Battle Creek Sanitarium since 1876. Author numerous books and papers, several of which are quoted from in this volume. For many years Dr. Kellogg has led a nation-wide fight in the treatment of diseases by natural means, including particularly hydrotherapy (the various applications of hot and cold water to diseased conditions) and the reformation of the diet so that substances, such as meat, that putrefy in the colon shall be eliminated. He has a large and enthusiastic following.

from the vermiform appendix. That many people seem to be well, even though they suffer from constipation, is due to the fact that the natural defenses of the body are not yet broken down. Toxins do not readily find their way into the circulation until after the mucous membrane of the intestine has its surface broken or ulcerated as the result of chronic infection. Sir Lauder Brunton is quoted with approval to the effect that the colon bacillus seems to have a special power of producing fatigue toxins, and many people in whom it exists in great abundance *suffer from constant weariness and fatigue.* Brunton's tentative assignment of inflammation of the joints, previously mentioned by Lane, as belonging to the same category, is also endorsed. Dr. Beezly Thorn is quoted approvingly to the effect that there are few phases of heart-and-blood circulation trouble with which disorder of some part of the alimentary tract is not causatively associated. Dr. Bottentuit personally informed the writer (Kellogg) "that practically all subjects of long-standing colitis presented myocardial weakness (inflammation of the muscular tissue of the heart) generally with dilatation." A. E. Garrod is quoted that "it has long been an article of faith that continued indiscretions in diet and overeating cause chronic arterial and renal (kidney) disease." He quotes further in support of his thesis that Dr. Mellanby, lecturer on physiology, King's College for Women, England, says that several powerful poisons which he names are found in the intestine and that two of them raise the blood pressure. That the above poison may be responsible for arterio-sclerosis (inflammation of the walls of the arteries) seems to have been proved by the work of Harvey, who produced marked hardening of the arteries and a kidney condition resembling the large white kidney, by giving small quantities of these substances by mouth to animals over prolonged periods. Dr. Alfred C. Jordan, "an eminent x-ray expert," is quoted to the effect that in many subjects intestinal stasis is marked in radiographic evidence of atheroma (fatty degeneration of the walls of the arteries), likewise of the aorta (the large heart artery) at

an unusually early age—another instance of the havoc wrought, says Jordan, on the tissues by intestinal poisons.

Dr. J. F. Birscoe is quoted with approval: "Who has not seen a prodigious evacuation of the bowels at the hands of the physician, terminate a case of insanity," and Dr. Lennox Wainwright, "physician to the Society for the Prevention of Cruelty to Children" (city not stated), is brought to the support of the statement that he is quite sure that the mental effect on many patients of prolonged intestinal toxemia is such as to make them almost demented, and he believes that if many of our asylums were invaded by a good physician who would approach the subject without any preconceived idea, many cases of melancholia and hypochondria (both disorders of the mind) would yield to common-sense treatment.

The foul condition of the breath speaks volumes of what may be suspected lower down, although the patient may not be constipated (in the usual sense). On this subject, 182 pages away, Dr. Kellogg drops into instructive anecdote. Some years ago a man who had fasted for three weeks consulted the writer on the 21st day of his fast. He had begun the fast for the purpose of getting rid of a foul tongue, a bad breath and various disorders which were clearly the result of chronic intestinal poisoning. He was disappointed in finding that all the symptoms had become worse. His tongue was heavily coated, his breath very foul, he was sleepless and greatly depressed and nervous. On inquiry it appeared that his bowels had not moved once during the entire three weeks. In answer to a question he remarked, "I took an enema the day before I began to fast and I have eaten nothing since; of course, my bowels have not moved as there is nothing to be moved!" A saline laxative was administered at once and within 24 hours the patient had several large and offensive stools and was greatly relieved. Needless to say this patient was cured of his desire to fast.

The author quotes with approval Dr. H. G. Adamson, physician in charge of the Skin Department of St. Bar-

tholomew's Hospital, London, that there are many skin diseases chargeable to this cause.

Ernest Clark, the eminent eye surgeon of Downing College, Cambridge, England, is quoted on degenerative changes in the eye, that although not generally recognized, the eye is an organ that registers in a very delicate manner certain conditions of the system, and amongst them intestinal toxemia is markedly one. The hardening of the lens may be delayed by the absence of, and accelerated by the presence of, certain poisons in the system, and intestinal toxemia takes a very high place in the list. One individual has an accommodative power of only 2½ diameters while another of about the same age has 8½. What is the difference between the two? In the first the lens has hardened prematurely and is only equal to the lens of a man of 55. That is, he is suffering from premature old age and, in the great majority of cases, in physical appearance, habits and powers, he is aged 55. There are many causes which advance this premature senility, but the factor common to a very large majority of them is intestinal stasis. On the other hand, those whose accommodative power is higher than normal look much younger, and on going into their history it will be found invariably that they have taken the greatest care to avoid the least suspicion of intestinal stasis. This premature senility of the lens is another proof of the truth of the old saying that a man is as old as his arteries; the premature hardening of the blood vessels often taking place at the same time as the process in the lens.

Commenting on the observations of Clark, Kellogg cites three of his own cases. A young woman of 18 found her sight failing. She needed glasses usually worn by persons of 50. By a change of regimen and improved bowel action the abnormality in a few weeks disappeared.

A college professor of 50 wearing glasses adapted to physiological long sightedness of advancing age, after following a changed regimen for a few months, found that his eyes improved to such a degree that he had the same range of accommodation as a normal person of 50.

A physician of 60 who had adopted a laxative, aseptic regimen (that would not be a source of putrefaction) found his glasses uncomfortable, and on examination by an oculist discovered that his glasses were ten years too old for him. A change was made to younger glasses and he was still wearing them at 66, although they were adapted to a person of 50.

In these cases, Kellogg says, the rejuvenation of the eyes was accompanied by the disappearance of numerous symptoms of senility, and a great increase in physical vigor and endurance.

Intestinal intoxication, says Hurst, is probably due more to the abnormally long period during which the feces are retained in the intestines and to the consequent excessive absorption of poisons than to any increase in bacterial decomposition.

The hepatic and splenic flexures of the colon being in contact with the kidneys, infection of the kidney may possibly result from the direct passage of the bacillus coli (bacilli of the colon, believed to be normally present but readily become virulent) from the intestines when constipation occurs. The more common infection of the right kidney would then receive an additional explanation in its close lymphatic connections (through lymph canals) with the cecum and ascending colon and in the more fluid consistence of their contents.[1]

Adami showed that when stasis occurs in the colon, especially in the cecum and ascending colon, where the contents are fluid and living bacteria most abundant, an excessive number may reach the blood. Those that escape destruction in the liver and spleen are excreted by the kidneys and pyelitis (inflammation of the pelvis of the kidney) may result. In the *British Medical Journal*[2] the same author says that when excess of bacteria are circulating in the blood they may collect in various situations where they break down and set free toxins which may destroy the cells in the neighborhood and cause the connective tissue to proliferate (the multiplication of similar forms, especially of cells and morbid

[1] Hurst.
[2] i, 177.

cysts). He believes that infection due to weakening of resisting cells from constant effort is overcoming toxic cells; also a condition in which bacteria become destroyed, and with their destruction liberate toxins which poison the cells around them, may account for the association of rheumatism, arthritis (inflammation of joints), and various other conditions with constipation.[1]

Chalmers Watson, commenting on the brilliant experiments of Carrel, of the Rockefeller Institute, New York, who found that living tissues growing in a sterile medium could have their life indefinitely extended by washing away the toxic products associated with the vital processes, says the conditions in the human being as a result of intestinal toxemia are, for practical purposes, identical with the above. As a result of imperfect removal of bowel waste slowly acting poisons are absorbed into the system, and induce the clinical manifestations (that is during the period of treatment) of toxemia.

Watson confirms what has already been said of rheumatoid arthritis (chronic inflammation of the joints). As a result of a close study of this disease for many years he has been led to share the view of its infective origin, the source of the infection being invariably one of the three mucous surfaces of the body. In the great majority of cases the infection comes from the gastro-intestinal tract, the mouth and the teeth being not infrequently primary factors in this intestinal infection. In the remaining cases the infection comes from the genito-urinary tract or the membrane of the lungs or bronchial tubes. He is satisfied that the disease is essentially curable in its early stages, and that if early cases were adequately investigated and appropriate treatment applied to the main source of the infection (the gastro-intestinal tract) we would soon see a profound change in the incidence of the disease, in the severe forms at the present met with.[2]

[1] J. George Adami, Professor of Pathology, McGill University, Canada, in *Journal American Medical Association*, 1899.

[2] Chalmers Watson, M.D., senior lecturer on Clinical Medicine, Edinburgh University; Physician Royal Infirmary, Edinburgh; Aloarengo Prizeman, College of Physicians, Philadelphia. Editor "*Encyclopedia Medica*." Author "Food in Health and Disease";

"The Book of Diet"; Lectures on Gout, Rheumatism and Intestinal Disorders. In Edinburgh *Medical Journal*, 1914.

In his new book on the "Conquest of Cancer" (December, 1923) Robert Bell, physician in charge of Cancer Research, Battersea Hospital, London, and vice-president of the International Society of Cancer Research, takes a strong position that cancer is caused by a contamination of the blood stream through intestinal putrefaction. He is also strongly in favor of medical treatment of cancer by injection and against surgical interference, having witnessed many cases of the development of malignancy from simple tumors through surgical operations. His cases are impressive.

Chapter XIV

STORY THE URINE TELLS

Normal urine is slightly acid, froths when shaken but the foam soon disappears when at rest.[1] The normal quantity is 40 to 50 ounces in 24 hours. On standing, a cloud of mucus is deposited, derived from the surface lining of the bladder and urinary passages. The specific gravity is in proportion to its concentration. This can be determined by gently dropping a urinometer into the fluid. This instrument is a glass tube usually about 5¼ inches long, weighted at the large end with quicksilver. When it drops into distilled water it sinks so that the zero mark lines with the surface of the water. Normally it should register from 12 to 25 points denser than zero—that is, the stem should rise—though it may rise, in the opinion of such a distinguished physiologist as Starling, as high as 1.040 and as low as 1.002 (from 2 to 40 points above 0) depending frequently upon such incidental factors as the drinking of a large or small amount of water.[2]

In Chittenden's observations on 9 athletic students and on 8 soldiers, referred to elsewhere, the average daily output of urine through a period of about 5 months was for the students 1,215 cubic centimeters (about 41.6 ounces), with an average specific gravity of 1.020, and for the soldiers 1,042 cubic centimeters with specific gravity of 1.023.

In concentrated urine, often associated with constipation, a deposit of *urate*s occurs on cooling. This dissolves when the urine is warmed. Under certain circumstances urine is turbid as it is passed, but in this

[1] Heitzman's "Urinary Analysis."
[2] Starling's "Physiology."

the turbidity generally consists of earthy phosphates, a salt of phosphoric acid, and is not cleared up by heating.[1]

The color of the urine varies with its density or concentration. Dense urine in health is a condition to avoid. After severe sweating the amount of water excreted by the kidneys is small and the urine has a deeper color. After copious drafts of liquid the color may be very pale, indicating desirable dilution, with increase of quantity.[1]

Normal urine is generally mildly acid as indicated by litmus paper which is turned pink. This is due to the acid end products of food broken down in the digestive tract, notably proteins, fully described elsewhere.

One of the striking facts about urine is that when we eat a meal rich in proteids, on the theory that meat, eggs, cheese, etc. are needed to maintain health, *nearly all of the distinctive element, nitrogen, soon appears in the urine,* which also increases its acidity under these conditions. This fact is set out in great detail and with much emphasis in the Nutrition of Man, by Chittenden,[2] Director of the Sheffield Scientific School, of Yale. It is also beautifully developed in the following important and instructive little table by Folin,[3] of Harvard, quoted by Chittenden, which is based on *two kinds of diet* for the same *healthy* man, one rich in protein and the other a week later, a diet with little protein:

	July 13		July 20	
Volume of urine ..	1170 c.c.[4]		385 c.c.	
Total nitrogen ...	16.80 grams		3.60 grams	
Urea-nitrogen	14.70 "	= 87.5%	2.20 "	= 61.7%
Uric acid nitrogen.	0.18 "	= 1.1%	0.09 "	= 2.5%
Creatin-nitrogen...	0.58 "	= 3.6%	0.60 "	= 17.2%

Commenting on this table Chittenden points out the marked difference in the percentage of urea-nitrogen in

[1] Starling's "Physiology."

[2] R. H. Chittenden, born 1856. Professor Physiological Chemistry since 1882 and director Sheffield Scientific School since 1898 at Yale. Author: "Digestive Proteolysis," 1895; "Studies in Physiological Chemistry," 4 volumes, 1884-01; "Physiological Chemistry in Nutrition," 1905; "The Nutrition of Man," 1907, Henry Holt & Co. Also many papers in American and foreign journals.

[3] Otto Folin, chemist, born Sweden, 1867. Professor Biological Chemistry Harvard Medical School since 1907.

[4] 1000 c.c. (cubic centimeters) = ½ gill over 1 quart.

the two cases—about 26 per cent. A similar difference is seen in the uric-acid nitrogen, and the great difference in the extent of protein broken down in the two dates, an excretion of 16.80 grams against 3.6 grams. The creatin, not being an end product of food (a result of the breaking down process), but a tissue product, remains about the same. Elsewhere he says no other form of food can take the place of proteid (same as protein as used by other authors). A certain amount of such food is needed to make good the loss of tissue material broken down in the various functions of the body. But we must be ever mindful of the fact that proteid does not undergo complete change in the body to simple gaseous products like the non-nitrogenous foods, but that there are left behind solid, non-combustible products which are not easily disposed of. As Curtis puts it, "the combustion of proteid within the organism yields a solid ash which must be raked down by the liver and thrown out by the kidneys. Now when this task gets to be over-laborious, the laborers are likely to go on a strike. The grate then is not properly raked; clinkers form, and slowly the smothered fire grows dull and dies." [1]

Referring to similar facts brought out by experiments of his own Kellogg says a study of his results will show at once the enormous amount of extra work put on the kidneys by a high protein diet. For instances the total quantity of urine eliminated by persons taking an ordinary high protein diet is 43 per cent greater than the amount required by the low protein diet without meat. *The acidity is more than double.* The total *nitrogen excreted is increased nearly 150 per cent.* The urea is increased in the same proportion while the ammonia, which is the result of putrefaction in the colon, is increased to nearly 3½ times normal. These facts, he says, show beyond any room for doubt that a high protein diet, or even the ordinary mixed diet, such as Folin was considering, comprising an excess of protein, compels the kidneys to do an enormous amount of extra and harmful work in order to remove from the blood

[1] Edward M. Curtis, M.D., "Nature and Health" (Holt), 1906.

the excessive amount of poisonous waste thrown into it.[1]

The reader here should carefully note the sequence set forth by Chittenden, Folin, Curtis and Kellogg. A diet rich in protein (food rich in nitrogen) means a urine as relatively rich in nitrogen, and this nitrogen is a waste product of protein that must be handled by the liver and kidneys. Elsewhere we learned that it comes from putrefiable food that is closely associated with putrefaction in the intestinal tract. So that the excessive use of food rich in nitrogen (largely from animal sources) not only greatly increases the labor of the kidneys and liver but is apt to set up a state of disease in the intestinal tract that may speedily lead to chronic invalidism of the most serious character.

See end of Chapter XXIX for table showing the relative value of different foods.

The reader should note in the table of foods referred to above that protein is found in nearly all the foods mentioned, even in strawberries, the exceptions being sugar and corn starch, pure carbohydrates. The foods called nitrogenous are those that have a high percentage of nitrogen, such as meat, cheese, fish, dried beans, chicken, eggs, etc. So that when authorities speak of a low protein diet they mean the selection of food that is relatively weak in protein. All the foods listed also contain fat except sugar and corn starch. Fats yield more heat per pound than carbohydrates because they have a larger percentage of carbon-oxygen for their combustion, by which is meant physiological combustion. In other words, says Chittenden, it is not a direct combination of oxygen with the carbon and hydrogen of foodstuffs, or tissue elements, that takes place in the body, but rather a gradual, progressive decomposition of complex organic compounds into simpler products; made possible by the agency of the oxygen from the lungs circulating in the blood.* The increase of oxygen required in the breaking down of fats in the small

[1] "New Dietetics" (1921).

* The word "combustion," while properly used in the above connection, is misleading to many because they associate the word exclusively with fire.

intestine makes them harder to digest than the carbohydrates, a difficulty greatly increased in weak digestions by the incorporation of excessive fats in carbohydrate foods, such as pie crust, fried potatoes, "short" biscuit, and other so called palatable foods.

If the reader is interested in not having his urine heavily charged with nitrogen with its promise of trouble in the kidneys, blood vessels, heart, stomach, gall bladder, appendix and joints he should note that there is a rich store of carbohydrates to choose from which, with the proper addition of food fats, will supply the body with the heat and energy required. If now is added about 60 grams a day of proteid food, as estimated by Chittenden, for a man weighing 154 pounds, a balanced ration can easily be calculated. What this will be can be gathered below from the rations given in detail of eight university athletes, all trained men, who for a period of five months, thrived on carefully calculated and recorded rations, of which we give a sample, the pound avoirdupois equalling 453.6 grams of the metric system, which is here used; so that 9 grams of nitrogen (not nitrogenous food) a day means slightly over 1/50th of a pound, or a little over 1/3 of an ounce.

Breakfast: Orange 60 grams, oatmeal 207 grams, roll, 46 grams, butter 14 grams, coffee 150 grams, cream 150 grams, sugar 35 grams.

Lunch: Boiled potato 150 grams, boiled onions 145 grams, macaroni 130 grams, fried rice 138 grams, syrup 48 grams, ice cream 160 grams, cake 26 grams.

Dinner: Celery soup 150 grams, spinach 100 grams, mashed potato 100 grams, bread 19 grams, coffee 100 grams, cream 50 grams, sugar 7 grams, strawberry shortcake 169 grams.

Total nitrogen content of the day's food equal to a little over 9 grams. The average for the last two of the five months amounted to 8.81 grams of excreted metabolized (utilized) nitrogen per man, corresponding to 55 grams of proteid matter.

The evidence of the nitrogen actually required to keep the body in a high state of efficiency as supplied by the experiment with the college athletes, was en-

larged by extended experiments with a detachment of twenty men from the army. They had been used to a diet of which the following is a sample:

Breakfast: Beefsteak 222 grams, gravy 68 grams, fried potatoes 234 grams, onions 34 grams, bread 144 grams, coffee 679 grams, sugar 18 grams.

Dinner: Beef 171 grams, boiled potatoes 350 grams, onions 55 grams, bread 234 grams, coffee 916 grams, sugar 27 grams.

Supper: Corn beef 195 grams, potatoes 170 grams, onions 21 grams, bread 158 grams, jelly 107 grams, coffee 450 grams, sugar 21 grams.

For a period of six months these men were kept on a diet of which the following is a sample:

Breakfast: Soft oatmeal 150 grams, milk 100 grams, sugar 30 grams, bread 30 grams, butter 10 grams, one cup of coffee, with milk and sugar, 350 grams.

Dinner: Baked macaroni with a little cheese 200 grams, stewed tomato 200 grams, bread 50 grams, tapioca peach pudding 150 grams, cup of coffee 350 grams.

Supper: Fried bacon 20 grams, French fried potato 100 grams, bread 75 grams, jam 75 grams, cup of tea 350 grams.

Total nitrogen content of the day, a little over 7 grams (7.282). The result of the five months' experiment is shown in the following table of 13 men for the two dates five months apart:

	Weight October, 1903		Weight April, 1904	
Stiltz	52.3	kilograms *	53.0	kilograms
Zooman	54.0	"	55.0	"
Coffman	59.1	"	58.0	"
Morris	59.2	"	59.0	"
Broyles	59.4	"	61.0	"
Loewenthal	60.1	"	59.0	"
Sliney	61.3	"	60.6	"
Cohen	65.0	"	62.6	"
Oakman	66.7	"	62.1	"
Henderson	71.3	"	71.0	"
Fritz	76.0	"	72.6	"
Bates	72.7	"	64.3	(Feb.)
Davis	59.3	"	57.2	(Jan.)

* 1 kilogram = 2 pounds, 3 ounces, 4⅜ grams = nearly 2¼ pounds.

Five of the men, says Chittenden, practically retained their weight or made a slight gain. Coffman, Loewenthal, Sliney and Cohen lost somewhat but the amount was very small and it occurred during the first few weeks after which their weight remained practically stationary. Fritz and Oakman lost somewhat but this likewise occurred during the early weeks. Bates was the only one who underwent any marked loss of weight. He, however, was quite stout and the work in the gymnasium, with the change in diet, brought about a desirable loss of body weight. With one exception, all the men were plainly having more proteid food than was necessary to maintain the normal nitrogen equilibrium of the body, the excess nitrogen balance in most cases being fairly large. Fifteen strength tests were made with each man during the six months' period. Without exception all the men made a phenomenal gain in strength although they were for five months restricted to a daily diet of only one-third to one-half the amount of proteid food they had been accustomed to.

Fothergill says it is wonderful how the craving for meat dies down in a man when he has once begun to realize that meat is not good for him. One may still think of the "fleshpots of Egypt" and yet feel the sight of a solid joint positively repugnant and offensive.[1]

Chittenden's tests upon himself as to the amount of protein (mostly food from animal sources) he needed to maintain the highest body efficiency are very interesting. Although Voit and Atwater had maintained (and had their conclusions generally accepted) that an adult for medium work requires from 116 to 120 grams, Chittenden as a result of his extended investigations reduced his protein intake to 34 grams (1 1/6 ounces). Two years later Chittenden stated in a personal communication to Kellogg[2] that his daily intake of protein was but 31 grams (a little less than 1 ounce). On this ration his strength and vigor were well maintained, his health improved, his weight remained steady at 125.4

[1] "Diseases of Sedentary and Advanced Life."
[2] "New Dietetics."

pounds (former weight 143 pounds) with clear light-colored urine, while he was able to get rid of some physical discomforts which were evidently the result of an excessive protein intake. F. G. Benedict[1] after experiments with students for approximately ten months was led to abandon his earlier view and confirm Chittenden.

It will be noted that the total amount of protein Chittenden allowed himself was about 1¼ ounces daily, which is equivalent to about 4 ounces of lean meat or 6½ ounces of roast beef, if nothing else containing protein were eaten, as practically all the foods except sugar and starch contain protein. Commenting on the practice he had adopted for himself he said, "It is difficult to accept the assumption that Custom affords any indication of the food requirements of the body. To the physiologist there is a lack of any scientific evidence that carries conviction."

The average man, says Folin, with ordinary habits of diet consumes more food from animal sources than the body can possibly use. The excess is not stored because the need of nitrogen is so small that an excess is always present in food not rich in that element.[2]

[1] Director of the Nutrition Laboratory of the Carnegie Institution, Washington.

[2] Otto Folin, professor biological chemistry, Harvard Medical School.

Chapter XV

INDICATIONS OF THE URINE GOING WRONG

When the physiological mechanism is working perfectly, says Porter, the urine is free from indican (a substance formed from indol, which has its source in intestinal protein putrefaction). If the urine is free from indican there is no putrefaction in the intestine.[1] If there is over production of uric acid (a reddish yellow crystalline acid, as obtained from urine), it may not be of any immediate significance; but unless the cause is found and corrected any excess may indicate grave structural changes in vital organs.

In testing for indican, it is necessary to understand the significance of the different shades of color obtained. In simple indicanuria, (showing the presence of indican without complications) the test reaction gives a clear indigo blue. When more or less toxic material is produced the color is a decided purple. The darker the color the more serious the toxemia (from putrefaction). In the type of red indicanuria the indican is not precipitated, as in the case of the blue forms, but the result is very pronounced reddish coloration of the urine in the tube above the surface of the chloroform (see figure), while the latter remains colorless. Other color reactions are a greenish coloration of the chloroform, indicating the presence of bile.[1]

When the assimilation is perfect the indican test invariably shows a sharp line of demarcation between the chloroform and the urine. If assimilation is im-

[1] William Henry Porter, professor emeritus in Pathology and Internal Medicine, at the New York Graduate Medical School and Hospital. In N. Y. *Medical Record*, March 19, 1921. Other authorities point out that this is very often so but not always.

Test for Indican

Buy an ounce of hydrochloric acid; same of ½% solution potassium permanganate, same of chloroform and a centimeter graduate. Take 10 c.c. (cubic centimeters) of urine, same of the acid and 5 drops of the solution. Shake. Add 5 c.c. of chloroform. Shake. Purple coloration followed by deposit of blue pigment shows presence of indican—the darker the color the more indican.

paired a more or less opaque disc forms at the junction of the urine and chloroform, varying in thickness from ⅛ to 1 inch. The location of the disc above or below the line has some significance.[1]

Obermayer's test for indican, recommended by Green: Put in a test tube 1 cubic centimeter Obermayer's reagent (15 drops) and an equal part urine to be tested, add 2 cubic centimeters of chloroform and thoroughly shake. A blue color will develop if indican be present.[2]

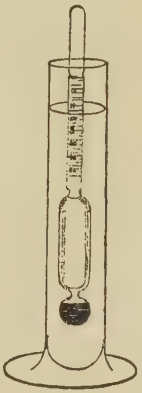
None of the indications mentioned are in themselves of serious import. They are given as showing some of the early manifestations of imperfect assimilation, which, in the classes of cases we are considering, arise from improper diet and overeating.[2]

The examination of the urine for uric acid (a significant end product of protein decomposition) and albumen, another protein product (frequently indicative of kidney inefficiency), should be entrusted to a physician who specializes in such examinations or to a physiological chemist. Traces of these substances may be present in the urine from natural causes and the presence of sugar, especially after a full meal, may also be sporadic and not indicative of diabetic changes already accomplished.

Urea, says Emerson,[3] is the ni-

[1] Same.
[2] Kirke's Physiology, edited by Green, Wood (1922).
[3] Charles P. Emerson, late Resident Physician of the Johns Hopkins Hospital; an

trogenous body of the urine present in the largest amount. The output of urea has been used as a test of digestion. A meal containing an excess of nitrogen may have included, for illustration, 500 grams of meat, 8 eggs and 200 grams of bread. During the same or the following day at least 50 grams of urea should be excreted. A normal person on an average diet is supposed to excrete 20 to 40 grams of urea each 24 hours. Why is there any great excess of urea at all in the urine? Urea is the chief nitrogenous ash of nitrogen food. Another opinion is that urea represents the excess of nitrogenous (animal food) intake of our food. Still another, that some of the protein food broken down is not resynthesized or built up again into a form to be used by the body.



Urinometer.

There is a simple and effective method of ascertaining if the kidneys are functioning properly. The density of urine, as shown by its specific gravity, is practically never the same in successive tests. This means that the more concentrated the fluid the higher a buoyant object will float in it. A urinometer looks much like a thermometer without the frame. It is buoyant and weighted with quicksilver. The lower it sinks in a fluid the lower the specific gravity of the fluid as indicated by a scale on the stem of the instrument. If a urinometer is dropped into urine each time it is voided during the day and the specific gravity noted these notations at the end of the day should show marked variations. Such a result indicates that the kidneys are active and functioning properly. If, on the contrary, there is slight or no variation it indicates that the kidneys are exhibiting incapacity. With copious water drinking the color becomes light while the specific gravity may drop in health to as low as 2 (according to Starling) which

Associate in Medicine the Johns Hopkins University. Author of "Clinical Diagnosis" (fifth edition, 1921), from which we quote (Lippincott's).

means but 2 points denser than water, and is written 1.002. Or in health, with heavy eating, it may rise to 1.015, or even to 1.040 on occasion.[1] In a few diseases, such as some forms of Bright's disease, the milder form of diabetes (diabetes insipidus), dropsy and heart disease, low specific gravity is one of the persistent symptoms.

A limpid, light-colored urine in sufficient quantity and of natural color, indicative of health, free water drinking and moderate dietary, quickly gives way to a dense, dark colored, aciduous and ill-smelling fluid, as soon as the digestive organs are overloaded with such food as meat and eggs and denied an adequate supply of drinking water. Here is a plain danger sign that few notice and fewer still heed. Tested with the urinometer such urine registers a high specific gravity.

Apoplexy, aneurism (localized dilation of a weakened arterial wall) angina pectoris (breast pang), sudden death from failure of power in a fatty heart—all are the outcome of the blood being loaded with nitrogenous waste. If these protein poisons had been removed all the rest could have been avoided. The bulk of the urine in these cases is commonly small, dark in color, yet of high specific gravity, well charged with urates of sodium, ammonium, potassium, calcium and magnesium. An excess of uric acid in the urine is called lithuria. It is precipitated by cold as if it were brick dust. Usually, too, the patient gets up at night to pass water. Sometimes a large bulk of limpid, light-colored urine alternates with this condition of scanty urine. In women especially there is breathlessness and palpitation in effort. Such a condition requires a sharply restricted diet involving a great deal of self-denial, but the result is worth all the pains. As to meat it should be confined to a little fowl or fish, plenty of vegetables and a mixed diet. This caution is particularly applicable where there is a tendency to a full habit or high blood pressure. The condition of the intestinal tract requires constant attention. A good drink in such circumstances

[1] Starling. This high specific gravity must not be persistent.

is citrate of potassium as often as twice a day, well diluted.[1]

[1] Digested from Fothergill's "Diseases of Sedentary and Advanced Life," by J. Milner Fothergill, late physician to the London Hospital for Diseases of the Chest. (Appletons.) A refreshing way of taking this drug is by mixing two solutions: (1) lemon juice and water, equal parts, 4 ounces; (2) bicarbonate of potassium 1 dram, water 3 ounces. To be mixed in the quantities desired and taken while effervescing. A powder, effervescent citrate of potassium, is obtainable possessing the qualities of the above mixture. (Hare's "Therapeutics," fourth edition.)

Chapter XVI

COARSE FOOD IN ITS RELATION TO COLON OUTPUT

The following instructive table by Rubner, professor of Physiology, Berlin University, shows results obtained from equal weights of different foods.

In grams[1]	Weight of feces	Weight of dried feces	Percentage of ingested food	Nitrogen
Bread from fine flour....	132.7	24.8	4.03	2.17
Bread from coarse flour..	252.8	40.8	6.66	3.24
Brown Bread	317.8	75.79	12.23	3.80

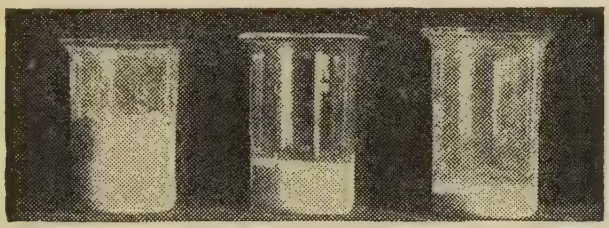
The above table shows clearly, for instance, the small residue from fine white flour bread as compared with brown bread—132 to 317 in round numbers. In another table Rubner extends this very useful information by showing the digestive refuse of a meal when made in turn *from one only* of each of the following substances, the necessary amount being eaten of each to satisfy energy requirements (figures representing weight of dried residue).

Meat residue	26 grams	Rice residue	50 grams
Eggs	26 "	Maize	51 "
Macaroni	27 "	Turnips	101 "
Wheaten bread	36 "	Potatoes	133 "
Milk	42 "	Coarse brown bread	146 "

Here we have one of the most important points in the physiology of digestion, that if food is capable of almost *entire digestion* and absorption the amount of residue is greatly lessened in bulk and largely limited to that produced within the intestine itself.

[1] Nearly 15½ grains.

In order to drive home this fact, that a great many of our modern physical ills are due to the popularity of foods that are not adapted to the human digestive tract, Kellogg entered into correspondence with one hundred and forty physicians—missionaries in remote regions where primitive people can be studied,—to find out if such people are free from constipation.



Bread in relation to quantity of digestive refuse. The smallest quantity is from a diet of white bread, the next larger from a diet of so-called brown bread, the largest from whole wheat bread. (After Gallant.)

From the replies received we make the following extracts.[1]

Cape Colony, South Africa: The staple food is stamped maize and sour milk; the absence of sour milk leading to constipation. In the Northern Transvaal the staple food is thick maize porridge, sour milk and in the summer green vegetables.

Toro, Uganda Protectorate, East Africa: The natives are almost entirely vegetarians living on millet, plaintain or beans. They rarely get meat. In 9642 outpatients seen during the last seven months of 1911 there was but 1.8 per cent suffering from constipation—174 cases. Commenting on this report Kellogg says that whereas in Uganda less than 2 per cent of the ill are constipated, in civilized countries in the same number of sick people there is scarcely one in a hundred who is not.

Dotson, extreme north Korea: Wheat, barley, oats, millet seed and all kinds of vegetables are the staple food. Very little fish and less meat.

[1] "Colon Hygiene."

West China: Bowel movement full and frequent among the working people, who eat large quantities of vegetables.

Pekin, China: The great majority of the people live on coarse grains and coarse vegetables.

Cheung Chow, Hongkong, China: Rice is the principal diet with quantities of vegetables. With this diet and exercise the healthy Chinaman usually has full bowel action.

Shepard, Anitab, Turkey: The principal food is boolghoor (cracked wheat) which has been cooked, dried, and the thin outer skin removed before cracking. It is usually boiled about ten minutes and a little melted butter added. They also eat coarse bread of wheat or barley, varied by lentils and other legumes (of the pea kind) with fermented milk (curdled) called youghurt. In defecation they never sit but squat.

Tabriz, Persia: Youghurt is the form of milk taken in Persia. Meat only occasionally. Youghurt is considered a laxative. Additional food in common use is cheese, coarse bread and fruit.

Bannu, India: People eat wheat, Indian Corn and millet seed breads. The supposed effect of the first is overcome by the last two which are laxative.

Amritsar, India: Motions are large, bulky and not formed. People here eat largely ground wheat and vegetables, not much meat.

Doctor Shepard, of Aintab, Turkey: There is little appendicitis here. I do from 500 to 600 important surgical operations a year with but 6 or 8 cases of appendicitis. All forms of cancer rare. Ulcers of the stomach common.

Forty-three physicians of the hundred and twelve in Mexico, Palestine, Arabia, Turkey, Egypt, South Africa, East Africa, Central Africa, Nigeria, Japan, Syria, Korea, Siam, Indian Asia Minor and the New Hebrides reported that they had never seen cancer of the bowels. Nine physicians scattered over Africa also reported that they had never seen a case of cancer of the bowels.[1]

[1] According to the Mortality Records of the Life Assurance Medical Officers' Association, London, 1911, quoted because of their accuracy, cancer of the stomach, rectum and intestines. exceed the

John C. Young, of Sheikh Ottoman, Aden, reports: The natives give prompt attention to the bowels. I have again and again had it given me as a reason for not living in Aden that people are not permitted to evacuate their bowels in public, as this is only permitted for children.

In "Diet and Race" (1920) F. P. Armitage [1] assembles from the various memoirs of travelers considerable information on the food of primitive man in various parts of the world.

Thus among the brown peoples of Queensland, Central and Northern Australia, the food is almost entirely vegetable, with occasional eggs, game, lizards and the like, which the husband often keeps for himself. Palmer gives an account of fifty-nine species of fruits, roots and vegetables and seven species of seed, all of which, raw or cooked, are eaten by the natives. Five of the former and three of the latter require the most careful treatment before they are fit for use. In Central and Northern Australia the only food seen in camp was, often, the raw or slightly roasted pods of the acacia. The natives near Sidney consumed as much flesh as any two Englishmen. Of yaws, roots, sour thistles, water grass and various fruits, there was no stint. In a native oven on the banks of Murrumbidgee, Matthew found a half ton of roots, cooked by several days' heating and beautifully white and palatable.

Hurst makes the observation that big eaters almost always have loose bowels, as a result of the excessive stimulus to intestinal activity produced by the large residue left by the bulky food. Stasis may be due to an insufficient supply of water, excessive loss of water by other channels and excessive absorption of water from the intestines. Many women drink much too little water.

total of all other forms. In a total of 9,163 deaths the principal cancer cases come in the following order: Stomach, 111, rectum 68, liver 93, intestines 43, abdomen 34, mouth 30. Eliminating the abdomen, all the above organs are associated with digestion, although the bad record of the mouth is charged to smoking by most authorities.

[1] Author of a "History of Chemistry," Director of Education of the City of Leicester, England, and formerly one of the heads of St. Paul's School, London.

Voluntary restriction results in a lessened desire as is the case with loss of appetite. When the colon becomes impacted it is unwise to give purgatives as the colic, which is generally present, indicates that the intestinal musculature is already contracting very actively. Belladonna is more likely to relieve the pain and cause the contraction to become more orderly. Enemata are generally indicated (fully treated elsewhere). A high enema [1] should be given at a very low pressure. On account of its irritant action glycerine should not be given in suppositories to patients suffering from proctitis (inflammation of the rectum) or hemorrhoids. Sempules (shaped somewhat like a dumb-bell—an English article) should be used instead of ordinary suppositories if hemorrhoids are present. They are made with a narrow neck that joins the broader conical end which projects into the rectum while the narrow neck remains in actual contact with the anal canal. The sempule should contain tannic acid or adrenalin if the hemorrhoids have recently bled, and tne slight mechanical irritation the sempule produces often suffices to complete evacuation.

Adolf Schmidt,[2] says that feces pressed into small cylinders indicates spastic constipation (contraction of the colon, usually the descending section).

Webster,[3] says the stool is much softer with a purely vegetable diet, of which about 85 per cent is water, than with animal diet, of which only 65 per cent is water (and with a relatively small residuum). Many factors may influence the amount of water present, such as a lessened absorption of water from the canal, *intake of a large amount of water* and an increased secretion from the intestinal glands. Webster claims that a large intake of drinking water directly influences the water content of the colon.[4] As a general rule, continues Web-

[1] At a temperature of 90° to 100°, says Kellogg, at bedtime, followed by a cool one at 80°.

[2] Professor of Internal Medicine, University of Halle, Germany.

[3] Of Rush Medical College, Chicago, in "Diagnostic Methods."

[4] Reference probably being for this effect to early morning drinking, thus contradicting Starling, the facts we think being with Webster.

ster, it may be stated that the greater the absorption of water from the intestine the more firm the residue. Clay-colored stools are caused by excess of fat sometimes with a deficiency of bile. Strumfell was able to obtain a light brown color by feeding patients a diet containing a small amount of fat, thus indicating that the fat was more important than the diminution of bile, although this latter is a cause also.

Cammidge [1] makes the observation that as a rule the longer feces are retained the darker they are. Hurst says that of two actions, one before breakfast and one after, the first is apt to be the darker as having been longer retained. The most prevalent normal color is a light reddish brown. These facts have a wide application.

Cammidge quotes Escherich to the effect that a 10 weeks old child taking one liter of cow's milk a day (half a gill over a quart) passed nearly ten times as much as a child of the same age fed at the breast. This is largely due to the quantity of food taken. On a vegetable diet Rumpf and Schumm found the output consisted of 370 grams. On a flesh diet Rubner gives 64 grams as the average weight, and Harley and Goodbody 54½ grams (nearly 31 grams to the apothecary's ounce). As a rule maladies beginning abruptly are accompanied by constipation. The time spent by the food in the intestines bears no relation to the frequency of the evacuations, an important fact. Defecation can be regular, yet the retention of the food residue be greatly prolonged. The form and consistency, in health, is mainly determined by the water content. Sometimes this is the result of the amount of intestinal secretion from the blood and the rapidity of the bowel movements preventing absorption or defective absorption from disease of the intestinal wall, etc. The consistency of the stools usually varies directly with their number, typical hard masses varying in size from a hazelnut to a walnut, and

[1] P. J. Cammidge, late demonstrator of Biology, St. Bartholomew Hospital, London; Author of "Diabetic Dieting and Cookery," "The Iodine Coefficient of the Urine in Diabetes," "Feces of Children and Adults," 1913, from which we quote, and other publications in medical journals. Graduated M.D., London, 1908.

frequently showing indentations of the tenia of the colon (one of the three muscular bands in which the longitudinal muscle fibers of the colon are collected). Still smaller masses are sometimes seen, resembling the dejecta of sheep. The presence of scybala indicates long delay of the feces in the large intestine. Bilious stools are bright, golden yellow in typical cases, but may have a greenish tint or even a dark green. The presence of unaltered, or but slightly altered, bile pigment in adults is always indicative of conditions of disease unless it is due to calomel, and indicates a hurried passage through the bowel.[1] Bloody stools may be scarlet, brownish red, coffee-colored or black. As a rule the higher in the alimentary tract the source of the blood, the darker is the color. Bright red blood, especially when on the surface, has a nearby source. Adherent blood, slightly changed in color, suggests the colon as its source. The black or coffee color has a stomach or duodenal source (first intestinal section below stomach) after hemorrhages. The odor depends partly on the nature of the food and partly on the decomposition changes undergone in the intestine. Both skatol and indol as a rule are present, both products of the putrefaction of proteins by bacteria in the large intestine. The intensity of the odor of these will depend upon the quantity of protein in the diet and the number of putrefactive bacteria in the large intestine[1] (fully discussed elsewhere).

Persons subject to constipation, headaches, so-called bilious attacks, or colitis, and who combat these conditions by an antitoxic dietary, should carefully note the stools from time to time, at least once or twice a week. The appearance of a dark color or putrid odor should lead to a prompt change in the dietary. A continuation of this condition means a constant absorption of poisonous material into the blood and gives rise to hardening of the arteries and increased blood pressure, while contact with the liver, kidneys and other eliminative organs, leads to their degeneration.[2]

[1] Same.
[2] Kellogg, "Auto-Intoxication."

Fothergill says (in "Diseases of Sedentary and Advanced Life") it frequently happens that as bilious persons advance in years they gradually cease to be bilious and become gouty. In both instances the liver is at fault; at first it makes bile acids in excess; later it acquires the vicious practice of forming urates instead (a salt of uric acid), both the outcome of the protein element of the food. In both conditions there are those *spots of pain in the back near the shoulder blades,* which are so characteristic of nitrogenized (protein) waste in the blood in excess; no matter what its form.

Large masses of mucus in the form of whitish or yellowish shreds or flakes, are due to colitis, a catarrhal condition of the large intestine, believed to be caused often by the free use of cathartics. Such disease may be present even if mucus may not be constantly found. Large masses of clear mucus due to irritation of the rectum sometimes precede or follow the stool. Mucus mixed with pus indicates an ulcerative condition of the lower bowel. When the ulcers are higher up the mucus and pus are apt to disappear through decomposition or digestion.[1]

With a coarse vegetable diet the bulk may be twice as great as normal. When the food and bacterial residue find their way through in from twelve to sixteen hours the consistency is never concentrated and hard with dark color. This condition develops only when it remains in the lower colon 24 to 48 hours or more. The color varies more or less with the food. Meat produces a dark color, milk yellow or orange-color. Fermenting materials have a generally slight acid odor; if much fat is present, a rancid odor. When putrefaction is well advanced there is a strong ammoniacal odor. Where the offensiveness is pronounced there is often a combination of rancid, ammoniacal and putrid odors.[2]

Muco-membranous colitis is a very chronic disease and there are cases of a duration of 30 years. Early

[1] Proce's "Textbook of Medicine," an English Oxford publication (1923), says mucous colitis should be treated with saline solutions (level teaspoonful to a pint); antiseptics, astringents and soap and water to be carefully avoided.

[2] Kellogg.

treatment is generally favorable but when there has been delay for years the outlook is very unfavorable. It occurs five times more frequently in women that men. The mucus is excreted as membranous shreds, which, in well marked cases, may form long tubular casts of the colon, sometimes called skins by the patient, the diameter being anything up to 1½ inches, with very thin walls. Sometimes they are rolled into a ball. The membranes may be passed alone or with dry, hard feces. Occasionally streaks or clots of blood are present owing to hemorrhage from excoriations of the mucus membrane or from anal ulcers or hemorrhoids, all of which may be produced by the hard scybala.[1] As they have been found to contain cells they are obviously derived from the epithelial (surface) lining of the mucus membrane. Nearly one-half the women who suffer from muco-membranous colitis have also some pelvic disorder such as uterine displacement, pelvic cellulitis (inflammation of the cellular tissue), uterine disease, or painful menstruation. In many of these cases the muco-membranous colitis is secondary to the constipation, which results from the reflex spasm or delay caused by pelvic disease or partial obstruction due to adhesions involving the pelvic colon. The spasm and accompanying pain is generally worse during menstruation. Fallen abdominal organs, including movable kidney, are frequently present, generally due to *weakness of the abdominal muscles.* Patients generally rest easier in a horizontal position which ameliorates the abdominal drag.[2]

Some practical comments by the present authors on the facts in this chapter seem called for. Consider the thousands in large cities who hurry through breakfast and then start immediately for the place of employment, frequently requiring, in the case of commuters, from one to two hours for the trip. Every incident of this morning rush, including the half masticated food, makes

[1] The irritation which hard fecal masses exercise on the mucous membrane of the colon and rectum leads in some persons to cancer. It is therefore specially to be avoided in old persons; since in them the tendency to malignant disease is greater than in youth.—"Longevity," by Sir Hermann Weber.

[2] Hurst.

for derangement of the digestive tract. And so with countless other complexities of modern business life.

One of the great hygienic advances of the world war among American troops was to do away in some fortunate commands with the closet seat. Round holes were cut in the floor and the men compelled to squat, with excellent results in the improvement of health, especially in the matter of hemorrhoids, which in many cases incapacitated men from service. In America manufacturing plumbers, with no adequate knowledge of requirements, have sought but one result—comfort and ease. But Nature does not take kindly to such coddling of muscles, particularly of the abdomen.

An interesting case points the moral. A physician was having trouble with a delayed delivery in childbirth where the patient had been laboring in the hollow of a soft bed in great pain for twelve hours. Another physician was called. He quickly took in the situation and had the patient gently lifted to the floor. She was assisted to a proper position where the muscles involved could perform their natural functions and a quick and safe delivery resulted.

In Pompeii a small cement-floored room, ten feet square, was found in a dwelling (villa) by a visitor, who had made the necessary inquiries, to contain a large stone slab, as thick as a curb, five feet long and four feet wide, which was hollowed out with rounded ends and sides. It was flat on the floor and was supposed to contain sand. Above it a smooth stone seat, a foot wide, five feet long, low in position, was supported by ornamented posts at each end well set back. A person in position on this slab, with feet rather high, would be compelled to bend sharply forward.

So much for twentieth century advances in civilization!

Chapter XVII

HARDENING OF THE ARTERIES AND BLOOD PRESSURE

Thickening of the innermost of the three coats of a blood vessel (sclerosis) in which both the elastic and connective tissue elements are concerned, in Osler's opinion, is perhaps the most constant feature in all types of arterio-sclerosis (a fibrous overgrowth associated with degenerative changes in the middle coat, causing thickening of the arterial wall with loss of elasticity and contractility). It may be out of all proportion to changes in the middle muscular coat of the artery and may narrow or obliterate the interior space. This is the most important single factor in the disease, responsible for more symptoms than all the others put together. It may be limited to one set of vessels, as of the legs or heart. The cause of this thickening is much discussed but is still in dispute. In lowered vital processes incident to old age and toxic (poisonous) forms, there is a replacement of muscle fibers by connective tissue, fat or lime salts, very much as occurs in larger vessels. The middle coat degeneration seems really as important in the small as in the larger arteries, and in the old age type lime beadings follow these degenerative changes of the muscle fibers.[1]

There can be no question that in many individuals the rise in blood pressure comes ahead of the appearance of the arterio-sclerosis. The four great factors in the case of the latter are the normal wear and tear of life, the acute infections, the intoxications and those combinations of conditions which keep blood tension high.[1]

[1] Digested from Osler and McCrea's "Practice," article by Sir William Osler, Vol. IV. Lea and Febiger, Philadelphia (1918).

The conditions of modern life favor arterio-sclerosis. The best express engine run day by day at maximum speed will not last one-tenth of the time it would if not so pushed. But nowadays with the human engine it is top speed or nothing and we cannot wonder that it early shows signs of hard usage. In the fourth or fifth decade (30 to 50 years of age), even with the best of habits in eating and drinking, the incessant strain and anxiety of business or public life may lead to a degeneration of the blood vessels. The tragedies of life are largely arterial. How often are the best and bravest called away in their prime—men whose only fault has been the unselfish abuse of the body machine?[1]

After 40 it is the exception not to find evidence of degeneration—here and there a small streak of intestinal fatty degeneration and with this the mitral and aortic cusps may have lost a little of their delicate tenuity, (cusp, a little knob at the center of the free margin of a heart valve; aortic, relating to the aortic orifice of the left ventricle of the heart). With advancing age the arteries become thicker and the fatty degeneration of the walls is more marked. As a rule, in the very aged not only the small arteries are thickened, but the aorta (the main trunk of the arterial system, arising from the base of the left ventrical of the heart), and its main branches show extensive changes with calcification (the deposition of insoluble salts of calcium, lime). Occasionally, however, a very old person may have singularly healthy blood vessels. Leading quieter lives women are not so frequently the subjects of arterial changes and in consequence they last longer.[1]

Of 52 post mortems at the Johns Hopkins Hospital in which notes of the condition of the aorta were made, evidence of sclerosis (thickening) were present in 30, and in 21 the changes looked recent. It is remarkable that out of 62 instances in which the condition of the coronary arteries (supplying the heart muscles) was stated, 19 showed sclerotic changes and in 13 these changes were recent. One of the Johns Hopkins house physicians, a very vigorous man of only 25, died in the third week

[1] Same.

of typhoid fever. There were patches of endarteritis (inflammation of the inner coat of an artery) at the root of the aorta, and numerous patches of yellowish sclerosis in both coronary branches.[1]

Of the poisons which have an important influence on the blood vessels, the special poisons from the outside are alcohol, lead and tobacco, the first named being very generally regarded as a potent influence in causing degeneration of the blood vessels. Tobacco is another poison about which it is very difficult to get conclusive evidence. Experimentally it is easy to produce the most extensive degeneration of the aorta in animals with nicotine. But there are many cases of inveterate consumers of tobacco for long periods who show no trace of vascular change. Nevertheless it rapidly raises tension and may cause spasm of the arteries, which factor may account for the cases of sudden death in young or middle aged men in whom excessive use of tobacco has been the only factor of causation. Angina pectoris (severe pain in chest from the region of the heart to the left shoulder) is sometimes associated with abuse of tobacco, and the influence may be, as Huchard and others believe, through inducing an arterio-sclerosis of these coronary arteries (of the heart muscles). A form of intermittent limping of the lower limbs has recently been attributed to the abuse of tobacco.[1]

Janeway, who did so much to advance the clinical study of blood pressure, in speaking of preventive treatment, says "tobacco is best sharply restricted" since it has a marked effect on increase of arterial tension.[2]

Our author's attention was repeatedly called to the frequency of arterio-sclerosis in persons who have been temperate in every respect except at the table. In the United States arterio-sclerosis is very common among the well-to-do classes who, as a rule, are abstemious as far as alcohol is concerned, but exceedingly careless and

[1] Same.

[2] Theodore C. Janeway, professor of Medicine, Johns Hopkins, and physician-in-chief, Johns Hopkins Hospital from 1914 to his death in 1917. In an article on "Some Common Misconceptions in the Pathological Physiology of the Circulation," N. Y. *Medical Journal*, Feb. 2, 1907.

indulgent in the matter of eating. In our bodies, as in an overstoked engine which is required to carry very much more steam pressure than necessary, damage is certain to follow from the accumulation of waste and a marked disproportion between intake, work and output. We have no positive facts that meat eaters are more prone than others to arterio-sclerosis but Indians (of the Indian dominions of Great Britain) and Japanese, who subsist chiefly on a vegetable diet, are said to be much less affected than Europeans.[1]

There are three great groups of arterio-sclerosis. First, that caused by the ordinary wear and tear of life and which is as natural as gray hair; next, the toxic or acute poison infections; third, causes relating to extremely high blood pressure. Practically in a given case of a man, say, of 55, two or all three factors may be present and it is extremely difficult to assign to each its relative value.[1]

The nature of the changes probably differs in different groups of cases. Slowly advancing, the peripheral (surface) arteries harden, the retinal vessels (of the eyeball) become more tortuous, the blood pressure rises to 150 or 200, the enlargement of the heart becomes more marked, and the urine shows a slight amount of albumin and tube casts. Very many of these patients, particularly those under 40 years, have marked symptoms of nerve weakness causing them to be irritable, sleepless, emotional. A marked loss of weight is not uncommon.[1]

Stevens [2] says the majority of the victims are persons of apparently robust health and many are overweight. Prolonged mental strain or anxiety, especially if associated with too rich living and deficient muscular exercise, is undoubtedly a potent factor. Alcohol and tobacco may play accessory rôles. The symptoms may be for a long time latent, and may be grouped in three classes. In the first they are referable to the heart and consist of shortness of breath on exertion, palpita-

[1] Osler.

[2] A. A. Stevens, A.M., M.D., professor of Applied Therapeutics, University of Pennsylvania. Author of "A Practice of Medicine" (1922), from which we quote, Saunders, Philadelphia.

tion and discomfort (in front of the heart) or severe cramp-like pain in the chest. In the second class the earliest manifestations consist of ready fatigue, lassitude, nervous irritability, disturbed sleep, vague pains in the back or limbs and varying combinations of the functional nervous derangements of the stomach. In the third class the first indications consist chiefly of dull headache, vertigo, noises in the ears and perhaps transient attacks of speechlessness, or paralysis of one side of the body. Less frequently the first indication is a slight blurring of vision due to small retinal hemorrhages, (eye). Occasionally convulsions related to epilepsy occur, especially at night. In this event the diagnosis is likely to be made of presence of urinary constituents in the blood.

Physical examination frequently reveals besides blood pressure which is often very pronounced—systolic 200 to 250, diastolic 110 to 140,—accentuation of the aortic sound (relating to the aortic orifice of the left ventricle of the heart) and more or less heart enlargement. (The systolic pressure is taken during the contraction, when the heart is in systole, producing the outward flow of blood through the arteries; the diastolic during the rest period while the heart is in diastole,* or filling with blood. The former is the maximum pressure and the latter the minimum pressure in the arteries at any given time. Systolic is the pressure usually referred to. The pulse pressure is the difference between the two.) For years there may be no obvious changes in the accessible arteries. Eventually, however, arterio-sclerosis supervenes, the vessels becoming thickened and tortuous. Except in advanced stages, when secondary changes have occurred in the kidneys as a result of heart insufficiency or of sclerosis (thickening) of the arteries of the kidneys, the urine is usually normal or contains but a trace of albumin and a few hyaline casts (composed of albuminous material). Functional tests indicate inefficiency of the kidneys. Examination of the eyes may reveal nothing abnormal, although in cases of long standing it frequently shows sclerosis (hardening) of the retinal

* Pronounced sys′-to-le and di-as′-to-le.

arteries (in the interior coat of the eye which receives the images through the lens), with hemorrhages and inflammation of the retina.[1]

This higher tension of the arteries is a chronic condition, often lasting 5, 10, 15 years or longer. In course of time it is followed by enlarged heart, hardening of the arteries and inflammation of the kidneys. If recognized early before the circulatory system of the blood has undergone any structural changes, it may sometimes be recovered from, and in the majority of cases materially aided.[1]

The average systolic pressure for women in a series of 200 observations recorded by T. C. Janeway was 10 millimeters (points) less than that of males, owing to less muscular development. The physical fitness and muscular development of the individual slightly affect the blood pressure. Exercise immediately before an examination, even so small as a short walk and a climb of a few steps to the doctor's office, will, if a rest does not intervene, sometimes affect the record as much as an exaggeration of 10 points.

Oliver [2] thinks the best series of normal systolic pressures on record is that afforded by 13,067 normal, *accepted risks*, by the Northwestern Mutual Life Insurance Co. of the United States (Milwaukee) which does not accept risks above 60 years of age. These figures are (both inclusive in first column) for 5-year periods:

Ages	Number of cases	Average systolic pressure
15-19	21	118
20-24	56	123.53
25-29	80	125.61
30-34	86	125.50
35-39	177	126.25
40-44	5,424	128.26
45-49	3,867	130.51
50-54	2,169	131.98
55-60	1,187	134.46

[1] Stevens.

[2] "Blood Pressure, Physiological and Clinical," by George Oliver, M.D., F.R.S. (London), Fellow of the Royal College of Physicians, where he endowed the Oliver-Sharpey Lectureship in memory of his old master, Sharpey.

It will be seen from this authentic record that the popular notion, frequently heard, that normal blood pressure is represented by the addition of 100 to the age of the individual is very generous. That figure is too high even for the age of 25 to 29. It will be noticed that 100 added to the age of 60 will show an error of 25.54 in excess of the correct average.

Brooks, New York,[1] in an article of notable clarity and authority expresses the opinion that high blood pressure is not a cause but usually a result. It is not a disease though the evidence of it. It is not pathological (indicating the structural and functional changes caused by disease) but is usually if not always physiological (a normal process). It tends more to prolong life than to shorten it. The purport of the discussion is that increased blood pressure is nature's method of meeting a condition of disease that has arisen in the body and that if the cause cannot be removed the blood pressure should be left as it is. He cites a case, in illustration, of a young man of 33 who was twice in the hospital—first with lobar pneumonia with a systolic blood pressure of 200, that during the course of the disease fell to 150; next under the care of the author at the City Hospital with a history of alcoholic excess and a systolic pressure of 190 to 200. Uremia developed (presence of urinary constituents in the blood) and he died. It was found on postmortem that the blood could not have been forced through the greatly shrunken and sclerosed (hardened) organs without a very high blood pressure; without it death must have taken place months or years before. With it very little real damage had been inflicted on the heart, which remained up to the end perfectly competent.

The only well known author, with a large experience, found who gives a definite method for the treatment of blood pressure is Kellogg.[2] He assigns the same cause to both arterio-sclerosis and high blood pressure by quoting with approval Prof. Henri Huchard, of Paris, to the effect that the former "begins by intoxication, con-

[1] Harlow Brooks, M.D., professor of Clinical Medicine, University and Bellevue Hospital Medical College, New York, in N. Y. *Medical Journal*, 1914.

[2] "New Dietetics."

tinues by intoxication and ends by intoxication," and also Huchard's further remark that the origin of the disease is alimentary, the change vascular (circulation) but the danger is renal (in the kidneys).[1]

The first thing to be done in arranging the regimen for persons suffering from high blood pressure is to change the intestinal flora (see Chapter XXVIII).

Foods containing uric acid in appreciable amount must be discarded,[2] also tea and coffee. A cup of coffee contains more than double the percentage of purin (source of uric acid) found in normal urine. Foods rich in oxalic acid, such as sorrel and rhubarb, must be discarded. Eggs must be used sparingly, and then the yolks rather than the whites. Potatoes and other farinaceous roots should be largely used (in place of cereals, breads and breakfast foods) because of the rich supply of organic bases (the element that combines with an acid to form a salt) which they afford and which neutralize the acids arising from tissue wastes *always present in excessive quantity in persons subject to arterio-sclerosis or high blood pressure.* Fruits should be freely used and greens in sufficient amount to furnish an adequate supply of lime and iron. The charcoal test should be frequently applied to determine how long the food remains in the colon. If more than 24 hours elapse before the black color disappears from the stools (see Chapter XXIV) further stimulation of intestinal activity is necessary and the amount of bran and paraffin oil (discussed elsewhere) should be increased.[3] In addition an enema should be used at night two or three times a week when a considerable amount of residue is found. It is desirable if bowel movements three times a day can be established. Vigorous measures for changing the intestinal flora should be adopted and continued until putridity disappears. In many cases the colon is so crippled that

[1] Same.

[2] Such as codfish, halibut, salmon, beef, veal, mutton, ham, liver, sweetbreads, chicken, turkey, rabbit, oatmeal, peameal, haricot beans, onions, asparagus ("New Dietetics"). See table of foods, end of Chapter XXIX.

[3] Same. An excess of paraffin oil is not desirable, for several reasons (leakage, for one), whereas the necessary increase in bran can always be tolerated.

the regimen for changing the flora must be repeated every few weeks in order to maintain a normal flora.[1] The adoption of an antitoxic and laxative regimen after change of the flora generally results in a pronounced lowering of the blood pressure, within a month. In the case of young persons or older persons who have recently acquired the high blood pressure, the tension can often be brought back to nearly normal. It is not an uncommon experience to note a drop in the pressure from 200 to 150, or even lower, within a few weeks, and then by the proper regimen it may be kept down for years. Dr. M. A. Mortensen[2] has reported thousands of such cases, one where a man past middle age whose blood pressure was reduced from 260 to 160 and still remained at this point after seven years, with the disappearance of other symptoms of ill health.

It is more than probable that colon poisons resulting from the putrefaction of meat residues in the colon are the most active of all causes of arterio-sclerosis. Dale showed that a poison found in decaying meat acts like supra-renal extract and raises the blood pressure at once from 110 to 260. Hence the great importance of a low protein and fleshless diet in these cases.[3]

The hardening of the arteries and high blood pressure, says Cabot, mean that the tubes through which the blood flows have become smaller and stiffer than they normally are. The heart is therefore called upon for more work. It compensates as we say; that is, gets larger. Thus for years the trouble is compensated so that these people may get along fairly well. In time the load becomes too great. But people with this type of heart trouble may live ten or fifteen years. They are more or less disabled all the time but capable of enjoying life if they do not try to be too strenuous. There is a characteristic trouble that goes with the disease—angina pectoris. This means a pain in the region of the heart which comes on after emotion or exertion and is relieved by rest. We often see in the street a pathetic

[1] The lactose regimen, described elsewhere.
[2] Of the Battle Creek Sanitarium Medical Staff.
[3] Kellogg.

figure pretending to look in the shop windows when he does not really want to. Perhaps he has been caught by angina and must stop. After a few moments' rest he is able to slowly move forward again. There are many causes for angina pectoris but arterio-sclerosis is the commonest. The nights are very bad when compensation begins to fail in any type of heart disease; and the patient with hardening and thickening of the arteries may expect many bad nights. Sleeping in a morris chair is a common practice. One man did it for years and went to business regularly the next morning. He had learned to sleep well sitting up.[1]

The rheumatic heart is due to infection. The streptococcus, the micro-organism back of the disease, may show itself in the throat (tonsillitis), or in the brain (chorea, St. Vitus' dance), in the joints (rheumatism), or in the heart, endocarditis (inflammation of the heart). This last disease begins usually in childhood and rarely after twenty-one, and is almost twice as common in girls as in boys. People can live fifty years with it and then die of something else, but this is frequently not the case, because fresh, virulent crops of the streptococci (micro-organisms of the intestinal tract) get into the heart and extend the old damage. This usually occurs before twenty-one. If mothers can take extra care of their children up to that age, even though the heart seems to be doing pretty poor work, the chances are good that it will settle down and be a useful organ for the rest of life. In such cases the heart strengthens itself, thickens its own muscle, and enlarges its cavities so as to overcome the defects in its valves. Failure of compensation occurs in children mostly when there are acute attacks of fresh poisoning, with fever. When compensation fails, either from this cause or from overexertion we get the symptoms swelled feet, short breath, difficulty in lying down at night, finally general dropsy.[1]

[1] Richard C. Cabot. Professor of Medicine since 1919 in Harvard Medical School. Chief of the Medical Staff, Massachusetts General Hospital, 1912, with other school and hospital connections. Author of several notable books on medical topics, the one quoted from being "Laymen's Handbook of Medicine," 1916 (Houghton-Mifflin), and several books on social and religious topics, a noted one being "What Men Live By."

The nephritic type of heart comes as a result of kidney disease. It results in holding back in the blood poisonous waste products which should pass out in the urine. Those poisons as they circulate in the blood stimulate the blood vessels to contract and this spasm produces high blood pressure. The two main causes of high blood pressure are arterio-sclerosis and kidney trouble. In chronic kidney trouble heart failure comes in about eighteen months from the patient's earliest complaint, making this the worse type of heart disease we have.[1] The treatment of all types of heart disease is rest, plus some measures which empty out the dropsical fluid from the tissues. It is really miraculous what rest can do, without other aid, after compensation has failed. A person who has seemed at death's door may recover and live for many years provided he can rest with no exercise that produces shortness of breath.[1]

Merely because a person has high blood pressure is no reason to fear a blood vessel will break for in fact it seldom does. High blood pressure does not necessarily mean anything serious, although arterio-sclerosis of the brain is the usual cause of apoplexy or cerebral hemorrhage (a "stroke"). In the brain arterio-sclerosis may lead to chronic insanity in a form that may be almost indistinguishable from paresis (incomplete paralysis with dementia). Prognosis of arterio-sclerosis (prediction as to the termination) is very difficult to state. On the whole people usually get too much worried about it. With the syphilitic taint, which with one exception makes the worst prognosis, the diagnosis rests largely on the Wassermann blood test[1] (the standard test for the syphilitic taint).*

[1] Same.

* High blood pressure is the pressure (or tension) of the blood within the arteries, maintained by the contraction of the heart, the resistance of the smallest blood vessels (arterioles and capillaries), the elasticity of the arterial walls and condition of the fluidity of the blood. Arterio-sclerosis is a fibrous overgrowth, mainly of an inner coat of an artery, associated with degenerative changes of the middle coat, causing thickening of the arterial wall with loss of elasticity and contractility.

Chapter XVIII

PURGATIVES—THEIR PROPER AND IMPROPER USE

Intestinal stasis coming on gradually after the age of 60, says Hurst, can at first be controlled by diet but sooner or later proper purgatives are frequently required. It is also often necessary in intractable cases (to be dispensed with as soon as possible) and in early stages of milder cases where non-medical methods are used, to give an occasional aperient (mild cathartic), *as defecation may at first be incomplete, even though it occurs at the proper hour.*

Many individuals, particularly if they live sedentary lives and eat to excess, are in the habit of taking a purge once a week or at other intervals even if they are not obviously constipated. The undoubted benefit that results suggests that they are really suffering from cumulative constipation. Such people if put on a moderate, well selected diet and induced to take proper exercise with deep breathing would no longer need the weekly purge.[1]

Many patients take an excessive quantity of drugs in order to pass one or more enormous, fluid stools. They need to be told that they are thus depriving the body of water, salt and nutrient material (and also setting up unnecessary irritation of the mucous membrane of the intestinal tract). A chlorotic patient (green sickness) was given cascara in addition to iron and arsenic for her anemia. Although but one stool a day was passed it was found by x-rays that bismuth taken at breakfast reached the rectum in six and a half hours instead of in forty-eight hours as had been her habit. Food

[1] Hurst.

passing thus rapidly through the intestines is not left long enough to be properly absorbed, so the dose was reduced.[1]

A middle-aged lady suffering from abdominal discomfort in the region of the right pelvis was given barium sulphate to take with breakfast with an x-ray examination six hours later. Although she had been told she was suffering from constipation the barium was already found in the rectum. This was proved to be due to the fact that she had taken her ordinary dose of cascara the previous evening as a subsequent examination showed that the passage was normal in rate without any aperient.* Her symptoms were, in fact, the result of *constant irritation of the intestines with aperients* which were not required. It is not uncommon for patients to get in a state of mind about aperients and use them when they are unnecessary. When finally convinced they succeed in reestablishing normal actions without particular difficulty.[1]

Aperients should be taken so as to bring on the desired effect after breakfast, so that absorption of food through the day may not be interfered with. The drug selected should be one that does not produce any inflammatory changes in the mucous membrane of the intestine with harmful reactions on the stomach, kidneys or other organs. If large doses are required, in severe cases, they should be given in three parts, after breakfast, after lunch and largest at night. The action of the drug is then less violent with less likelihood of colic or catarrh. Where aperients must be used constantly (or the patient thinks they must be) they should be changed from week to week, so as not to lose their effect.†

[1] Same.

* Dose according to Hare, 20 to 30 minims (drops), with much smaller doses at the beginning. If a larger dose is required, then an adjuvant, or assisting remedy, should be added, as larger doses of cascara may produce irritation of the bowel.

† One can be selected, for instance, in which podophyllin is the active principle, one in which aloes is and one with cascara. Study the effect of these drugs in this chapter.

Alkaloids

These occur in plants in combination with plant acids. They are sometimes called the organic bases of plants, as morphine, nicotine, quinine, etc., and are intensely bitter.[1]

(1) *Nux vomica, strychnine.* Strychnine, which has the properties of nux vomica, sometimes appears useful in those forms of constipation which depend on depression of the nervous system, especially when given in connection with vegetable aperients.[1]

(2) *Belladonna, atropine.* The active principle of belladonna is due to atropine derived from the leaves of the poisonous nightshade. It is an anti-spasmodic and all its preparations are poisonous. Most vegetable purgatives give rise to more or less griping which can often be entirely overcome by combining them with a small dose of belladonna.[1]

(3) *Opium* (*morphine, codeine, papaverine*). Opium is valuable in those cases of constipation which are associated with pain, such as in biliary and renal colic ("stone") in rapidly curable forms of intestinal colic and for that due to lead poisoning. It is generally most effective when given in connection with a saline purgative. The initial good effects are generally replaced before long by its ordinary constipating action.[1]

Vegetable Purgatives

These irritate the intestinal mucous membrane and thereby give rise to a local reflex in Auerbach's plexus (a plexus or net work of sympathetic nerves between the coats of the intestine) which results in increased muscular activity. Those most commonly used do not irritate the stomach, as some, such as aloes, only act after they have become dissolved in bile, while others, such as castor oil, after they have been split into active substances by the pancreatic ferments of the pancreas. Vegetable purgatives are supposed to act on both the

[1] Hurst.

small and large intestine. X-ray observations show that this is only true of cascara and castor oil, while aloes and senna act on the large intestine only.[1]

Podophyl'lum. Derived from the roots of the May apple or mandrake. It also contains a resin, *podophyllin* (accent on the "oph"). It is the slowest acting purge in use. This valuable drug particularly excites the flow of bile. It is best given in constipation when the stools are dark (Sidney Ringer[2]). In children one or two months old with hard, stony stools, podophyllin is the best remedy. A grain of the resin should be dissolved in a dram of alcohol (teaspoonful). Of this 2 drops on sugar are to be given once or twice a day. In children who suffer from watery diarrhoea stools which have a musty smell, the resin in the dose of 1/60 to 1/50 of a grain (1 drop on sugar as above) is of service, often succeeding when all else fails.[3] The resin is the best preparation in adult use also, the best pills containing from 1/8 to 1/10 of a grain.

Aloes, aloin. Aloin contains nearly all the active principles of aloes, which is the dried juice derived from the cut leaves of various species of aloe. It was used by the Greeks and Romans and is now probably the most generally useful of all purgatives. A friend of Lauder Brunton had not found it necessary to increase the dose after forty years' continuous use. Aloes acts rather slowly and stimulates the colon only. It is therefore often best taken after dinner instead of at bedtime. One of the best pills for use in chronic constipation is composed of half a grain of extract of nux vomica and a quarter of a grain of the alcoholic extract of belladonna, with from one-sixth to one grain of *aloin,* or three times this amount of *aloes* (dried juice of the leaves of the plant) the exact dose being adjusted to produce a single formed stool each morning.[1]

[1] Hurst.
[2] An eminent English physician.
[3] Hare's "Therapeutics."

Hare says constipation occurring in plethoric persons should not be treated with aloes as they need salines and it should not be used if any irritation or catarrh of the intestines is present with pregnant women, except most carefully, lest abortion be pro-

Cascara sagrada. (Spanish for sacred bark.) This drug is derived from the dried bark of the California buckthorn. It was used by the North American Indians as an aperient but was not introduced into England until 1877. The x-ray shows that it has the disadvantage, when compared with aloes, of acting on both the small and large intestine. Like aloes it acts most efficiently when given with nux vomica and belladonna.[1]

Senna. Was introduced into western Europe from the Arabs, who used both the pods and leaves. Its action does not begin until it reaches the cecum (beginning of the ascending colon). There appears to be no increase in secretion, the action being solely due to stimulation of the colon movement. It tends to cause griping and nausea. This is due to a resinous element which is absent in preparations made with cold water. The requisite number of pods are allowed to stand in cold water for four hours or more and the infusion is drunk the last thing at night. If any discomfort is produced five or more drops of tincture of belladonna can be added to the infusion just before it is drunk. A patient may start with six pods and easily and accurately increase or decrease, after which the dose should be decreased, one pod at a time as the condition improves.[1]

Castor oil. Herodotus (of ancient Greece) described its cultivation by the Egyptians. It was introduced in Europe at about 1764. On account of its mild but certain action and the absence of griping, castor oil is perhaps the most valuable of all purgatives for occasional use, with a dosage of a half ounce to an ounce. It is valuable in the constipation of old age and in spasticity (contraction) of and inflammation of the colon especially when belladonna or codeine is given simultaneously. The bad taste can be materially lessened by first rinsing the mouth with lemon juice or eating a piece of peppermint candy. Larger doses are best taken in one swallow with lemon juice or peppermint

duced, nor where there is congestion or inflammation of the liver, but is recommended in such an inflammatory condition as hemorrhoids.

[1] Hurst.

water, with which the medicine-glass should be first rinsed.[1]

It should be used where bad food has been eaten even if the inflammation set up after taking the food is very active. It tends to produce hemorrhoids if used constantly and its frequent use, or even in a single dose, is generally followed by constipation. This is one reason why it is useful in irritative diarrheas; having swept out the mucus and offending matter it checks the movement of the bowel. The purgative effect is very much increased if a little bicarbonate of soda is given with it. A very effective purge in very obstinate constipation consists of 1 ounce castor oil and the same amount of aromatic syrup of rhubarb. Some cases of neuralgic headache may be cured by small daily doses, of castor oil, given preferably in capsules of from ¼ to 1 gram.[2]

George W. Crile, the well-known surgeon of Cleveland, Ohio, stated before the surgical section of the American Medical Association that castor oil was recommended to him by John B. Murphy, the late eminent surgeon of Chicago, as a preliminary treatment in operative cases of facial neuralgia, as in a considerable percentage of cases it rendered an operation unnecessary. Dr. Crile stated that he found the advice sound and to this extent confirms Hare. The only explanation offered by Hare is that the treatment prevents toxemia (which in turn has caused nerve irritation) by unloading the bowels.

Castor oil is, to a certain extent, independent of dose, and the dose is not much influenced by age. An infant may safely be given a teaspoonful or two, a dose that will usually physic an adult. The quantity of oil that exceeds the digestive capacity is passed through unchanged acting like so much paraffin oil. Excessive action is therefore impossible. For an adult the usual dose is 1 or 2 tablespoonfuls.[3] Because of the reliability of its action and the impossibility of excessive effect it is the purgative of choice for delicate invalids, infants, and where hemorrhoids are present. It is a good remedy in intestinal colic.[3]

[1] Hurst.
[2] Hare.
[3] J. E. Thayson (a leading Danish authority).

An outside authority, a practicing physician of high standing and a large practice, says it is always his first remedy when called in digestive cases of children. In about nine cases in ten he finds no other medicine is needed. And yet this old and reliable remedy is notorious for its tendency to leave the bowel sluggish after use. Consequently it should not be used in chronic constipation. The best way to prescribe it is in elastic capsules of agreeable size.

Rhubarb. Contains an astringent that gives it, when used in unloading the bowels, a secondary constipating effect. This quality is useful in some cases, as in children where an ordinary laxative is followed by diarrhea. In summer diarrhea, where it is desired as a preliminary treatment to get rid of fermenting material, rhubarb is useful.[1]

Salines

Saline purgatives act mostly as such by causing an increased amount of water to remain in the intestine or pass into the intestine through its walls, so that the weight of the increased liquid really causes the purgation. For this very reason a saline will act better if the patient is up and about. The slower the salts in absorption the better they are as purgatives. Salines interfere with the absorption of water from the intestine and if they are in concentrated solution attract water from the blood. Hence when they act all this water is passed and the patient often feels faint and thirsty. They should be well diluted. Three 8-ounce glasses of water are not too much for such a purpose. If concentrated, salines remain in the stomach until there is sufficient water to make them of uniform density with the blood (isotonic), and during this process irritation of the stomach and mucous membrane is caused and the passage delayed. They should not be taken at night.[2]

This interesting observation may prove an adequate explanation of the fluid residue which Hawk elsewhere says

[1] Digested from Hare's "Therapeutics."
[2] Osborne's "Therapeutics," by Oliver T. Osborne, professor of Therapeutics, Medical Department, Yale University.

may be found in many stomachs in the morning—a lack of dilution in the form of a few sips of water.

A saline taken before breakfast acted in thirty-five minutes, whereas the same dose given another morning, when no breakfast was taken, required seventy minutes. When a dose is given of a saline purgative of proper strength the x-ray shows that the whole of the large intestine, from the cecum on, may be completely emptied. But little acceleration is produced on the chyme in the small intestine. The advantage the salines have over many vegetable purgatives, such as cascara and castor oil, is that they do not interfere with the passage of chyme through the small intestine. Salines do not suit all people as in some cases they produce abdominal discomfort, nausea and headache, without acting on the bowels. Many find them most agreeable, however, while in nervous individuals, owing to the loss of a considerable amount of fluid, they have a tendency to produce depression. If hemorrhoids are present particular care should be exercised that no larger dose than enough to produce one action should be taken.[1]

Sulphate of sodium (Glauber salt) is a saline cathartic more disagreeable but less active than magnesium sulphate, over which it has no material advantage.[2] Dose 4 drams.

Sulphate of Magnesium (Epsom salt). One of the most active of the saline cathartics. Dose 4 drams. Same in an effervescent solution containing about 7% of magnesium sulphate with syrup of citric acid, potassium citrate and water. Dose, the contents of a bottle, nearly 12 fluid ounces.[2]

Sodium phosphate. As a saline it is less active than magnesium sulphate and sodium sulphate and also less disagreeable to the taste. Dose a rounded teaspoonful divided between two glasses of quite warm water an hour and a quarter before breakfast, half the quantity in each glass. It does not dissolve in cold water. The same in effervescent form represents approximately but 50

[1] Hurst.
[2] "Useful Drugs," a digest of the U. S. Pharmacopeia, issued by the American Medical Association, fifth edition, 1921.

per cent of sodium phosphate as described above. If the dose is carefully regulated, more or less than the above to get proper effect, sodium phosphate is very agreeable in its action. In small doses slightly laxative only.

Particularly useful, says Hare, for bottle-fed children who continually alternate between diarrhea and constipation and also useful in rickets to regulate the bowels. The late Roberts Bartholow of Philadelphia believed this to be the best remedy in cirrhosis of the liver and jaundice.

Fothergill observes that for the stimulation of the liver soda is the alkali par excellence.[1] Significance is given this remark by the fact that bile has as its two principal ingredients two sodium salts—that is sodium that has combined with two different acids.[2]

The mild action and agreeable taste of phosphate of soda commend it especially for children to whom it may be given in milk or other food. In chronic gastric catarrh with constipation small doses in hot water before meals often have a very beneficial effect on both the stomach and bowel. Taken in the same way it is a valuable depletive (lessening the fluids of the body) in simple catarrhal jaundice (due to swelling of the bile ducts from catarrh), secondary to inflammation of the duodenum (immediately below the stomach). Dose 2 to 4 drams.[3] (The ordinary dose in health is a teaspoonful, 1 dram, with variations.)

Mercurials—Calomel

These were formerly believed to act by increasing the flow of bile but more recent observations have shown conclusively that they have no actions on the liver. The belief arose because of the green color of mercurial stools, but this is now known to be due to the prevention of the decomposition of the bile by the antiseptic action of the calomel. Calomel has the great disadvantage of being

[1] Fothergill's "Indigestion and Biliousness."

[2] Granular phosphate of soda comes in pound containers (not the effervescent form, which is much higher in price and has much less strength). The Merck Brand, sodium phosphate, Merck & Co., New York, retails at 35 cents per pound.

[3] Stevens' "Therapeutics," Saunders (1923), professor Applied Therapeutics, University of Pennsylvania.

very uncertain in its action. In some persons even small doses may produce severe poisoning which is very difficult to combat, as there is no method of rapidly getting rid of the mercury. Calomel is valuable for occasional use, particularly in so called biliousness, in which the furred tongue, lack of appetite, general malaise, headache, discolored membrane of the eyeballs and constipation result from gastro-intestinal disorder and not from any liver condition. Mercurial purgatives should never be employed in chronic constipation as they are too irritating and may result in mercurial poisoning.[1]

Hare says calomel should be given in doses of 1/6 to 1/2 a grain every half hour until 1 to 2 grains are taken. Only the calomel that is changed in the intestine into gray oxide is active. As the amount of alkaline juice in the intestine is small only a minor part of a large dose acts, the major portion escaping unchanged. This is the reason that bicarbonate of soda added to the calomel aids the intestinal juice in the reduction of the salt. Other authorities cite cases where calomel and soda administered in 1/10 grain doses for the calomel every 30 minutes up to a total of less than a grain, are effective. All doses should be followed by a saline so that no free mercury is left in the system.[2]

Practical Suggestions

In choosing an aperient one can be selected in which aloes or aloin is the active element, one in which podophyllin is, and one in which cascara is. There are many good pills on the market. Here are four:(See footnote 3).

1.	Purified aloes	1 grain
	Extract hyoscyamus	1 grain
	Extract nux vomica	⅓ grain
	Powdered ipecac	1/10 grain[3]

[1] Hurst.

[2] Tablets of 1/10 of a grain, one every 20 minutes, with a quarter glass of warm water, as late in the evening as possible until 7 are taken, is an average dose.

[3] This pill has been discontinued. A good substitute is the Lady Webster Dinner Pill, of the strength 2 grains of aloes to the pill. The Parke-Davis pill has but 1¾ grains. Dose, 1 pill experimentally late every second night (this should be read in connection with the last paragraph of page 126) with a glass of warm water.

The aloes here is the active element. Hyoscyamus is used instead of belladonna as an anti-spasmodic, to allay excessive secretion and exercise a favorable influence where local inflammations are beginning. Nux vomica is the tonic element. Ipecac in small doses acts as a stimulant to the secretions of the mouth, stomach, intestine and liver. Next

2.

Aloin	1/8 grain
Podophyllin resin	1/8 grain
Ext. belladonna leaves	1/8 grain
Strychnine	1/80 grain
Oleoresine capsicum	1/10 grain [1]

Here the active ingredients are the aloin and podophyllin, associated with belladonna (about the same effect as the hyocyamus in No. 1), strychnine in place of the nux vomica as the tonic, and the capsicum (red pepper) as a digestive stimulant, especially in alcoholism. Note the smaller dosage of aloin as compared with aloes.

3. Cascara compound No. 3 (Dr. Hinkle) is as follows:

Cascarin	1/4 grain
Aloin	1/4 grain
Podophyllin resin	1/6 grain
Extract belladonna leaves	1/8 grain
Strychnine sulphate (nux vomica)	1/60 grain
Oleoresin ginger	1/16 grain [2]

The first three are the active agents here with three assisting remedies (adjuvants). The ginger is employed for its flavor and to prevent griping. There are three strengths of this excellent pill. The above is the weakest.

4. An aloin pill without podophyllin with an excellent reputation is as follows:

Aloin	1/4 grain
Strychnine	1/60 grain
Extract belladonna	1/8 grain
Ipecac	1/16 grain [3]

[1] Product of Parke, Davis & Co.
[2] "Lepactic," Sharp & Dohme.

If plain cascara is desired instead of pills it can be bought in tablets of 2, 3, and 5 grains each. Used steadily the dose will soon have to be strengthened.

If bran is taken freely the ordinary dosage of pills can be reduced. They are used occasionally on the theory that there is generally an accumulating residue even where the bowels are supposed to be in good condition. This observation is easily verifiable.

If any laxative pill is taken with a glass of warm water an hour before dinner, on an empty stomach, the dosage can be lessened a third or more and the time required for action shortened to about 7 hours.

The late Sidney Ringer[1] called attention to the fact that in constipation or "biliousness" with light-colored stools calomel is indicated but in the same condition with dark-colored stools, podophyllin. Hare says he has proved the correctness of this opinion so frequently that he is convinced of its truth.

Much of the comment, some of it adverse, on the guarded use of such useful drugs as aloes, cascara, podophyllin and phosphate of soda avoids the real question. If a patient is well informed and follows the best hygienic practice but finds through the use of charcoal markers or otherwise that the early morning water drinking, bran, abdominal exercises etc., still leave something to be desired, there is ample warrant in authority for the use of a laxative every other day if results are found to warrant such a procedure. In the case of aloes, for instance, the books give the regular dosage at from 2 to 10 grains. Regular resort to such strong dosage is, of course, to be condemned. But we see above that the maximum dosage is but two grains per pill, and this is likely to be sufficient where the other helps are used. So the real question is, which is the better practice, to have the body habitually, chronically poisoned by a putrefying residuum or see to it with care that a good clearance is secured at weekly or bi-weekly intervals by the moderate use of friendly drugs: Of one of these Stevens says: "Aloes is rarely used as a cathartic but in *simple, persistent* constipation it is very efficacious in combination with

[1] An eminent English physician. (See footnote page 129)

other remedies, particularly nux vomica, belladonna, ipecac, rhubarb or podophyllin. Contrary to what was formally believed, aloes is not contraindicated by hemorrhoids unless inflammation has developed. Indeed the drug often benefits *indolent piles* by overcoming the sluggishness of the bowel that led to their development." [1]

In an extensive clinical study of the subject Thayson [2] says that primary, habitual stasis, usually begins before the age of 26 in women and 31 in men. Those crippled by age, incurable infirmity or chronic systemic disease (affecting the body as a whole) such as kidney, liver, heart or lung affections, require habitual laxatives. So do those suffering from a weak or diseased intestine, just as a person with weak ciliary muscles (of the eye ball) need eye glasses or a person with a weak leg needs a crutch. Such a cathartic should be prescribed with as much care to fit the patient properly as is taken in refracting a patient's eye.

It is a well known fact that intestinal intoxication phenomena are much more prominent in diarrhea than in constipation, and some people feel weak and miserable, as though poisoned for a few days after purgation. Of course this may be only temporary and the theory is that the purgatives stir up the intestinal contents and the poisons are then more readily absorbed into the circulation.[2]

Pruritis ani (an external itching at the discharging end of the intestinal tract) has been widely but not finally ascribed to acid stools. Beyond question many cases are relieved after a demonstrated intestinal disorder has been controlled.[3] An interesting inquiry, recalling the observation of Russell and Strasburger of the presence of increased stomach acidity in many cases of stasis (see Chapter XI) has been the presumptive establishment of a relation between pruritis and gastric acidity. It will be remembered that in Russell's opinion there are practi-

[1] A. A. Stevens, Professor of Applied Therapeutics, Medical Department, University of Pennsylvania, in his "Materia Medica and Therapeutics" (1923).

[2] J. E. Thayson in the *Ugeskrift For Laeger* (Danish), January, 1919.

[3] "Endocrinology and Metabolism" (Appleton), Vol. 4 (1922).

eally but two classes of digestive disorders, one characterized by excessive acidity of the digestive fluid of the stomach and the other by a deficiency of the acid element (hydrochloric) of the gastric juice. Accurate observations in many cases are necessary to determine whether pruritis ani is associated generally with this acid condition. In at least some cases it has been found that a teaspoonful of phosphate of soda dissolved in hot water and diluted by two or three glasses of water taken an hour and a quarter before breakfast, every morning for two or three weeks, with no meat in the diet, has produced almost immediate relief. This solution has a mild alkaline reaction.[1] With this treatment should go absolute cleanliness through the frequent use of a good grade of castile or other bland soap. As to ointments an excellent one is benzoinated vaseline and oxide of zinc.[2] It comes in tubes and has enough body to protect the irritated surface for a considerable period, whereas a thin ointment like for instance vaseline and carbolic acid, soon disappears in contact with the heat of the body. Kellogg recommends an ointment consisting of

Lanolin (fat from sheep's wool)	2 drams
Boro-glyceride (boric acid and glycerine).....	1 dram
Good cold cream (freshly made)	6 drams

If necessary, he adds, to relieve the itching, menthol may be added in the proportion of 10 grains to the ounce.[3]

Calomel is extolled by Hamburger (quoted by Pennington[4]), the powder being rubbed in on the cleansed parts. This is very effective if cautiously used. A good substitute is calomel (20%) ointment.

[1] See a fuller discussion of this saline in Chapter XVIII.
Sodium phosphate in quantities too small to move the bowels is absorbed into the blood, the alkalinity of which it slightly increases, and is supposed by some to combine with any excess of uric acid to form soluble urates, which are readily eliminated—*National Standard Dispensatory.*

[2] Cheesebrough Mfg. Co. (subsidiary of the Standard Oil Co.).

[3] "Colon Hygiene."

[4] Of the department of Rectal Diseases, Columbus Hospital, New York City.

Meats of all sorts, says Kellogg, especially the lean meats, tend to acidify the tissue fluids to a marked degree. Eggs, meat extracts, broths, gravies all belong to the acidifying foods although eggs to a less extent than meats. These are foods that, for want of bulk, produce the most pronounced derangements of the intestinal tract.

The condition of alkalinity or acidity of the colon contents that indicates health is often a puzzling one.

Many bacteria of the alimentary canal produce putrefactive changes. They render these contents *alkaline*, produce different gases and elaborate more or less virulent poisons. Other species often set up an acid condition, seldom accompanied by gas or toxin (poison) fermentation. The species that produce acids are more resistant to the action of acid. Thus when the stomach has an excess of free hydrochloric acid (a vital element of the gastric juice) a much larger percentage of putrefactive, disease-producing organisms in the blood are destroyed or rendered inert than of the bacteria of acid fermentation. Diminished stomach acidity allows the entry of a greater number of putrefactive types, with intestinal derangements.[1]

And Kellogg says a slight acidity of the colon contents is a good indication showing that the putrefactive and poisonous germs of protein food have been displaced by the beneficent acid-formers. To this end he recommends three or four actions a day brought about by wheat bran, fruit, vegetables, and the free use of dates which are especially valuable because of the grape sugar they contain. He is firmly of the opinion that the increase in the number of actions a day is one of the surest ways of overcoming putrefaction. The habit can easily be cultivated. This is shown in insane asylums where the inmates speedily establish the proper habits.[2]

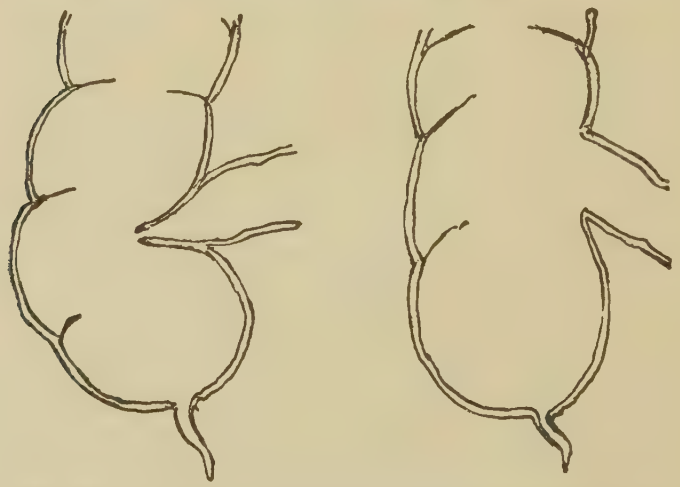
[1] Digested from Encyclopedia Britannica, Vol. 8, 266.
[2] "Itinerary of a Breakfast."

NOTE TO SECOND EDITION.—Many people can take laxatives for years without having to increase the dose and without harm that we can see; but are afraid of its effects and must be reassured that if they do not have to increase the dose there is no reason why they should not take it for forty or fifty years more.—*Cabot's Layman's Handbook of Medicine.*

Chapter XIX

INFECTION OF THE SMALL INTESTINE FROM COLON

The ileo-cecal valve, the organ of defense against infection of the small from the large intestine, stopping the back flow of the latter, has been carefully studied



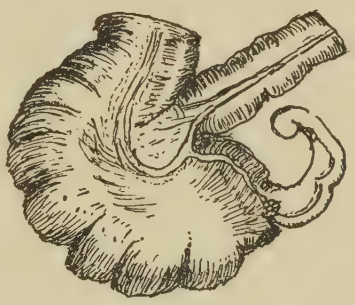
Competent and incompetent ileo-cecal valve, guarding any back flow from the colon into the small intestine. (After Gant.)

only within recent years and the principal honors in connection with such study belong to Case.[1] Fortunately

[1] Jas. T. Case, roentgenologist at Battle Creek Sanitarium, Battle Creek, Michigan, and St. Luke's Hospital, Chicago. House Surgeon, Battle Creek, 1908-10; assistant house surgeon since 1910. President American Roentgen Society, 1919-20. Born 1882. Author "X-ray Examination of the Alimentary Tract," 4 volumes, 1914. Quotations are from *Archives of the Roentgen Ray*, July, 1914, and April, 1915.

an impaired valve has not been found to be irremediable. If the abdomen is opened in any other operation an injured valve is easily repaired. Without this simple surgical operation much can be accomplished by hygiene and a correct diet.

Case reported in 1912 that out of a series of 200 consecutive gastro-intestinal cases, many of them constipated, one-sixth showed incompetency of the ileo-cecal valve as shown by a barium enema. In 1913 in a series of 1500 cases there were more than 250 cases of incompetent ileo-cecal valves. Case further observes that he has often noted that the small intestine has been empty at the 12th hour, all the contents having passed into the colon after a bismuth meal, yet observation the next morning showed bismuth back again in the terminal ileum (last part of the small intestine), no fresh bismuth meal having been taken in the interval. In every instance where the ileo-cecal valve proved incompetent to the enema, the surgeon at the operation found gas or fluid distension of the terminal ileum, often to a distressing degree in spite of thorough efforts at preoperative bowel cleansing. Wherever the ileo-colic (ileo-cecal) valve has proved competent to the enema the surgeon has in a great majority of cases found it so.

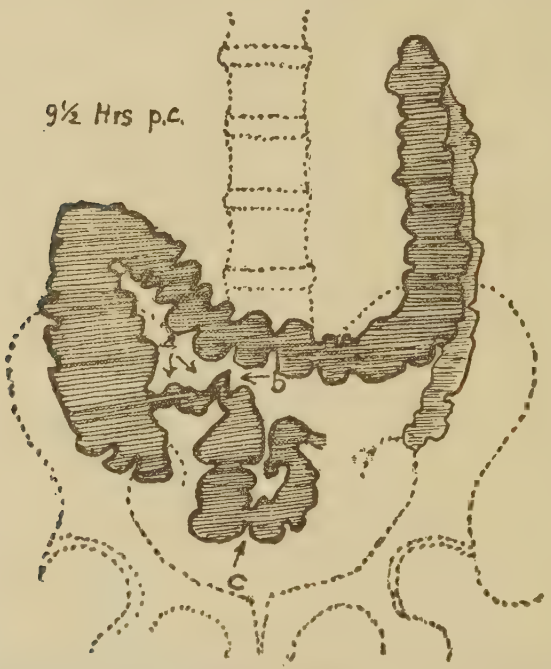


The union of the small and large intestine with appendix in the chimpanzee.

Still further proof of the normal competency of the valve is found in the fact that the incompetency found at operation has been cured in a number of cases by a simple surgical procedure.

Referring to Kellogg's more recent publications on this subject he does not recommend opening the abdomen for the repair of the valve, although the operation is not a difficult one. He says that when the valve is defective

reverse movements force the liquid food residues in the cecum (beginning of the ascending colon) back into the small intestine. Sometimes in this way, several feet of the small intestine may be filled with fecal material forced back from the colon.[1] Says Schmidt as quoted by



Nine and a half hours after a barium meal with some of it still in the terminal coils of the ileum (small intestine). Caused by an incompetent valve. Arrows point to sympathetic contraction of the terminal ileum. (Case.)

Kellogg: "The ileo-cecal valve forms a sharp line of demarcation above which (that is, in the small intestine) putrefaction never occurs except under conditions of disease. If protein decomposition extends up into the small intestine far greater quantities of indican (indica-

[1] "New Dietetics."

tive of putrefaction) appear in the urine than ever occur through absorption in the colon." Patients in whom the valve is wholly incompetent, continues Kellogg, are usually subject to a most distressing accumulation of gas in the intestine. The crippled valve may be repaired by a surgical operation that has been done in many cases with marked benefit to the patient. But the operation is not likely to be a permanent success for the reason that it deals only with a result, the cause of the trouble, the overdistension of the colon, still remaining. The rigid antitoxic diet is of the highest importance in cases of this sort. *The food should be of such a character that the residues will not encourage putrefaction even if delayed for some time in the colon, and the intestinal flora should be changed* (discussed elsewhere). If the bowels cannot be made to move freely they should be emptied by means of an enema at night. The best temperature is from 80° to 90°.

Chapter XX

MINERAL OIL AS A LAXATIVE

The *Journal of the American Medical Association* for Nov. 22, 1919, says through a staff writer that the rapidity with which "mineral oil" (petrolatum) has conquered the globe has been phenomenal. It is now a most extensively used substance and if its sale were any indication of its medicinal value, we should have to consider it one of the most valuable of medicaments. Petrolatum is a bland, odorless, tasteless and colorless liquid, indigestible as well as incapable of decomposition by bacteria; hence it cannot become rancid. It is not absorbed, therefore it cannot produce poisoning in any dose. A pint of liquid petrolatum has been given in a few hours without untoward results. While it is merely of temporary value in habitual chronic constipation and possibly may still further increase the intestinal sluggishness by lessening the amount of intestinal exercise, it seems to have an actual curative effect in certain conditions, as, for instance, in spastic constipation (spasm of the intestine but frequently used as meaning a contracted colon at some point) to which by lessening the irritation, it may ultimately succeed in lessening the irritability.

Wherever it is desired to soften the feces petrolatum is indicated.* To speak of this action as lubrication is hardly correct. Lubrication depends upon the formation of an oil film such as it is impossible to apply to a water-soaked membrane. When an excess is used it generally gives rise to the much complained of leak, which may occur even with small doses.[1]

On this point Kellogg says that paraffin oil has the

[1] Same.

* Hurst, as we have already seen, proved by experiment that water is the better solvent in such cases in enemas.

very important quality of being a highly active solvent of the poisonous waste with which it comes in contact and takes up a considerable portion of the toxins found in the intestinal tract. When paraffin is used it may always be seen in the feces, showing a brownish or blackish color, due to the substances it holds in solution. In a laboratory test made by a competent chemist it was found that when paraffin oil was shaken with a watery solution of indol (a poisonous product of the colon) more than half the indol was quickly taken up by the paraffin. The use of half an ounce of paraffin at bedtime and half as much more *an hour before each meal* will generally in a few days change a putrefactive condition completely. Its effect in hemorrhoids has been found very favorable and the cases requiring operation greatly reduced. Another special advantage the oil has is that the beneficial effects are not diminished by continued use as is the case with almost any other laxative. It has long been known that the workmen engaged in paraffin works are especially subject to cancer. A commission appointed by the British Government to make a special study of the subject showed by the report of its specialist, Dr. H. C. Ross, of the Lister Institute, London, that paraffin oil contains substances associated with anthracene (a hydrocarbon derived from coal tar), which are believed to be, under favorable circumstances, capable of producing cancer.[1]

An investigation of mineral oil was made under the auspices of the American Medical Association and a report published March 6, 1915, by W. A. Bastedo, of New York, of the Committee, from which it is seen that the committee started its work by collecting three kinds of liquid petrolatum: A light "Russian" oil; a heavy "Russian" oil, and an American oil which was markedly fluorescent (having surface colors). The collaborators were advised that the reports should furnish information as to the size and frequency of the dose, the agreeableness of the taste, the effect on the stomach, number and character of stools, degree of admixture of oil with other material, degree of leakage, and need of other cathartic measures.

[1] Kellogg in New York *Medical Journal*, 1914, and in "New Dietetics."

From eight clinical reports submitted the following conclusions were drawn:

Dosage.—Half an ounce to three ounces a day. In the same patient the same amount of each of the oils was required.

Frequency of dose.—The same amount daily seemed as efficient when given in one dose as when given in divided doses two or three times a day.

Stomach tolerance.—In about 20 per cent of the patients the oil produced a slight degree of nausea. This is most likely in patients who have gastric stagnation with retarded emptying of the stomach. All the oils acted the same in this regard. Vomiting was reported in two cases.

Effectiveness.—To produce one or two copious stools a day the required dose varied considerably (as stated above) but there was no difference on account of the specific gravity or character of the oils.

Character of stools.—They were soft, usually formed, sometimes not, obviously greasy. They had a peculiar odor described as sour. Their consistency varied with the dose but was the same for the different kinds of oil.

Admixture of oil with other ingredients.—Generally well mixed but from time to time a patient would pass free oil. This occurred with all varieties of oil. It necessitated reduction of the dose and if then the bowels were not active enough, the administration in addition of cascara, aloin, etc.[1]

Leakage.—A disagreeable feature complained of by many was that when enough oil was taken to move the bowels there was a sufficient leakage to sometimes stain the clothes.

Mineral (or cottonseed oil) warm as it can be borne is particularly useful in spastic constipation[2] (page 49), introduced by funnel, short rubber tubing and hard rubber end piece. To be used on alternate evenings for the night, 8 or 9 ounces, quite warm, with diaper to prevent leakage.*

[1] Why not bran?

[2] Osborne and Fishbein's *Handbook of Therapy,* American Medical Ass'n. (1923).

* As to the English Medical Commission that investigated the increase of cancer among those who work in paraffin, the fact of such increase seems well established. It is not thought paraffin oil that has been purified by reputable firms is dangerous.

Chapter XXI

AGAR OR BRAN? WHICH?

The use of agar (a dried seaweed from the East) in constipation was first suggested as late as 1905 by Prof. Adolf Schmidt, of Dresden, Germany. Since then a wide experience has extended its use in every civilized country. A search of the medical literature of the subject fails to find any dissenting opinion against its proper use. Dudley Roberts [1] in *International Clinics* [2] says it sometimes happens that the ingestion of agar causes stomach discomfort when it is taken before the flakes are slightly softened by admixture with semi-solid food. Aside from this no disturbances have been observed from its use.

It should be pointed out, however, that when it is taken in too coarse a form and hurriedly swallowed before it is thoroughly softened, it has a tendency in some cases to irritate the throat. To avoid this the substance should be cut fine enough so that the longest piece is less than a quarter inch in length. Another difficulty to be overcome, and frequently not realized is the slowness of its progress along the intestinal tract. This is no fault of the agar but a consequence of the stasis from which the patient is suffering. Many people have experimented with the substance only to reach a hasty conclusion that it has no value for them. As a matter of fact before reaching such a conclusion four or more days should be allowed to elapse before discontinuance. In such cases instead of discontinuing the agar the bowel up as far as the cecum should be relieved by coloclysters or "high" enemas, at a temperature where the health is good, of 80°, a section

[1] Attending gastro-enterologist in 1911 of Brooklyn Hospital; consulting gastro-enterologist, Coney Island and Kings Park State Hospital, Brooklyn.

[2] Vol. 4, Series 21.

of the colon at a time. The overloaded colon is not infrequently in a condition so bad as to cause a block and furnish a big surprise to even intelligent people.

In order to overcome this condition and give the agar a fair start Kellogg[1] says that the quantities of fęcal matter removed in these cases is sometimes enormous; and not infrequently putrefying masses, semi-hardened by long retention, make their appearance after a free coloclyster (irrigation of the whole colon) has been thoroughly administered every day for a week or more, showing that a single irrigation of the colon, no matter how thorough-going, is not sufficient to establish the fact of its thorough cleansing. As long as the patient complains of gaseous distension and fetid flatulence the coloclyster should be administered daily. Care should be exercised against using an excessive quantity of water at once. The amount need never exceed two quarts and the quantity should be reduced from day to day. The warm enema can cause a distention of the bowel. If used at a temperature of 92° to 95° it should be followed by a pint of water at a temperature of about 70° and retained as long as possible as a tonic to the bowel. If the patient reacts well a regular temperature of 80° is recommended after which the cooler water need not be used. The temperature of the clyster when the purpose is to flush the portal circulation (to the liver) and at the same time relieve the alimentary canal should be from 90° to 100°, followed by the cooler water as above.[1]

With its progress through the colon thus facilitated the agar should make pretty nearly normal progress and increase the fecal bulk until the colon by its contractions and peristaltic movements is able to successfully engage it. (The technique of the enema is more fully treated elsewhere.) In cases where the constipation is due to the so-called "greedy colon," agar or bran is indispensable. In such cases the colon has acquired the power to eat up large quantities of the cellulose of the food so that it is very difficult to increase the bulk by the use of green vegetables. This is the reason for the disappointment of many who hoped to find in the free use of lettuce and like

[1] "Rational Hydrotherapy" (water cure), 1918.

green foods a panacea for their intestinal ills. Agar has been found as a rule to be indigestible. It should be taken at meals up to an ounce in cereal, coffee, fruit juice, stewed fruit so as to be thoroughly mixed with the food, or stirred into a glass of water and quickly swallowed. When food cannot be taken, and when there is no appetite, agar can be taken in place of food in fruit juice or fresh stewed fruit and an extra dose can be taken before going to bed. In this way the intestinal rhythm is maintained by keeping material in the intestine.[1]

Studies made in the laboratory of Mendel, at Yale,[2] showed that agar in great part was excreted unchanged and could be readily recovered. The agar easily retains water in the alimentary residue and prevents the formation of the hard masses. It was this property together with the resistance of the agar to bacterial decomposition, with the production of gases or other noxious products, which led to the suggestion of its use as an element in the diet. But the experiments may not have been extensive enough to arrive at final conclusions. No claim is made that it will produce permanent cures but it is harmless and brings about a condition that approximates natural functions.

One objection to agar, which is a Japanese and Ceylon seaweed, is that it is shipped to this country in coarse bags under sanitary conditions that are not the best, and without being properly cleansed. Various cleansing processes are practiced by the different producers, some of them seriously objectionable. When properly prepared pretty high prices are asked, up to 75 and 80 cents per quarter pound. Also some producers attempt to doctor the article by adding licorice or other substance to change its taste, although in its clean form it has no taste worth mentioning. It melts at the temperature of boiling water and jellies at a temperature above 120° in which condition Kellogg says it makes an excellent substitute for objectionable animal gelatine.[3]

[1] Louis M. Gompertz of Yale, "Constipation Clinically Considered." *American Journal of Medical Sciences*, 1919.

[2] L. B. Mendel, prof. Physiological Chemistry, Sheffield Scientific School, Yale University.

[3] Which is digested while the agar jelly is not.

Bran has several very important advantages over agar. It is very much cheaper, cleaner, and has the very desirable quality not possessed by agar, of not packing. The principal good quality of agar is that it is an indigestible and non-irritating dried seaweed that increases greatly in bulk in the presence of moisture. But bran has all these qualities and the additional ones mentioned above. As impaction of the colon contents in chronic constipation is the most serious condition to provide against, it has been demonstrated that a substance like bran, which disintegrates the contents of the colon, and at the same time greatly increases their bulk, performs a service not secured from agar. In addition the disintegrated mass does not lie closely against the wall of the intestine like agar and therefore is not so much subjected to the loss of its moisture by absorption, a very important point. The key to its successful use is to take it in ample quantity after each meal instead of once a day.

The best bran is produced, it is believed, by large and responsible milling concerns, where it is handled under good hygienic conditions, sterilized and carefully packed in pound and a quarter containers, which retail for about sixteen cents, a twentieth of the price of good agar.*

Some producers cook it beyond the point of sterilization but this is not recommended as the bran crumbles to some extent and thus loses some of its most desirable qualities. Other producers grind it too fine. Examined under a magnifying glass it will be seen that each particle looks as if it were removed entirely, or almost whole, from the grain of wheat. There are several layers in the bran, the inner ones being nutritious. On the inside a white substance clings that is a part of the gluten of the grain. Probably half of these flakes after use curl up into thin, elongated spirals to which the adjective spicate is applied (spear shaped). These inside layers are thoroughly digested down to the outside hull. It should not be taken on an empty stomach. A pound of whole wheat contains 37 grains of potash. A pound of bran contains 119 grains of potash (thus showing that a large percentage of the wheat potash is in the bran), while a pound of fine flour

* Pillsbury's and Educator are both good brands.

contains only 11 to 12 grains of this important food element. Bran contains one-twentieth of its weight of salts, one-thirtieth of its weight of phosphate of potash and 7 to 11 times as much valuable salts as are found in fine flour. Ordinary bran contains nearly one-fifth cellulose, 37 to 100 times as much as does fine flour and about 43 per cent of starch and sugar, while of mineral matter and fat there are 9½ per cent. The use of bran can be greatly facilitated by its inclusion in muffins, biscuits, griddle cakes, mashed potatoes, mush, potato and onion soup, cookies, and macaroons.[1] Contrary to misinformed public opinion in certain quarters, carefully fostered by producers of white flour at an excessive price, bran and graham flour are not irritating. In an article on the subject in the *Journal of the American Medical Association*[2] in its department of Therapeutics, the following important statement is made:

"Bran is chiefly to be looked on as a form of almost indigestible carbohydrate which is endowed with considerable laxative value, not only because it adds by its bulk to the distention of the intestine but also because of the spicate shape of its particles. Excessive irritation does not result from these, for when properly moistened and heated, bran becomes as soft and pliable as wet paper and produces merely a gentle titillation, and is usable even by patients with a tendency to colic."

One of the easiest and simplest ways of taking bran is to first decide upon the proper amount needed, *not in weight but in bulk*. Rubner[3] has found that the average weight of the feces of a meal made up of fine white flour is 132.7 grams; of bread from coarse flour 252.8 grams; and from brown bread 317.8 grams. The average of these weights is 234.4 grams, or about half a pound. A proper mixture of bran *in a chronic condition of serious impaction* (note the qualification) in such a bulk is an 8 ounce glass nearly full a day. Frequently the amount must be decreased and sometimes in bad cases, increased. This can be divided into as many portions as there are

[1] Kellogg, "New Dietetics."
[2] Not a contribution but by a member of the staff; Dec. 6, 1919.
[3] Professor of Physiology, University of Berlin.

meals. With three meals one-third of this amount should be taken with each meal either with the food, or within an hour after a meal, stirred in a glass of water and quickly swallowed in large draughts. Many uninformed writers advise teaspoonfuls of bran. Such small portions have little effect. This practice explains why so many people fail to get results from bran that are easily possible. It should be taken as food is taken, in liberal quantities. Bulk is a fundamental requirement. With it a normal condition is present as in primitive man. Without it the colon contents become impacted and dry and the colon inert—it does not have sufficient material to work on. Then follows the delay—stasis—which develops into a chronic state. Unless such a condition is fully realized and capably met there is little or no hope of worthwhile relief.

One of the most obstinate and common forms, spastic constipation, accompanies colitis (inflammation of the mucous membrane of the colon characterized sometimes by colicky pain, constipation or diarrhea and the passage of mucus and membranous shreds). This form derives its name from the fact that its cause is spastic (spasm) contraction of the colon, acute or chronic, usually below the splenic flexure. Because this condition accompanies colitis it is often thought that bran and other roughage should be avoided. This is an error, says Kellogg. Roughage is more needed in this form of constipation than any other. Bran is of signal benefit in such cases. It is of most importance that the colon membrane should be kept clean. For this reason the colon should be emptied once or twice a day by an enema at not less than 100°-102° to clean and relax the bowel. When colitis and spasm are not present this should be followed by a cool irrigation at 70° to 85°. Paraffin oil as a lubricant is useful, as spastic contractions vary from day to day. Rough palpation (with the fingers on the surface) sometimes produces a violent and painful contraction, while gentle friction may cause relaxation.[1]

The interesting question of the *nutritional value* of bran is shown by the following comparison between bran

[1] "New Dietetics."

and a high grade of patent white flour, both analyses from the same source:

	Water	Protein	Fat	Starch and sugar	Cellulose	Mineral
Bran	12.5	16.4	3.5	43.6	18.00	6.0
White flour ..	12.4	11.2	1.0	74.6	.02	0.5[2]

The astonishing fact here is that in every element, except sugar and starch, bran exceeds the high grade white flour.

[2] "Dietotherapy," 4 vols., Appletons (1923).

Chapter XXII

VITAMIN KNOWLEDGE INCOMPLETE BUT VERY IMPORTANT

What may be called the Vitamin theory as applied to food is based on one of the great discoveries of this century and is as yet far from being completed. The starting point was the study by Takaki, Medical Inspector General of the Japanese Navy, of the prevalence of the disease beriberi in the Japanese fleet wherein he reached the conclusion that the disease was caused by protein starvation. He devised a new ration to meet the condition, which was first very successfully used in 1884.

Twenty-three years went by before an eminent Dutch physician (Eijkman) came along with the announcement (1907) that he had experimentally produced a disease of dietary origin (beriberi). Eijkman also made other additions to our knowledge including the fact that if rice polishings were added to the condemned Japanese diet it would prevent the disease of beriberi. (Polished rice had been used in the Japanese navy.)

At the present day it is a common fact of medical opinion that beriberi is caused by a dietary deficiency of certain accessory food substances that have been called vitamins (vi′-tam-en, formerly written vitamines).

As to the substance of Vitamin A and B (originally called by E. V. McCollum fat soluble A, and water soluble B) they have not as yet been isolated and their character established. We become aware of their presence in food by a process of elimination.

McCollum reasoned that all types of nutrients are contained in a seed such as the wheat kernel, except possibly the unknown one which had been demonstrated to be present in certain fats. It was believed that valuable

data might be secured by enhancing the protein, the inorganic element and the fat factors separately in feeding experiments. Accordingly McCollum and Davis in experiments that consumed much time and developed many perplexities fed the wheat kernel in the following combinations to rats and obtained the results noted: (1) Wheat alone. Result, no growth, short life. (2) Wheat plus purified protein, same result. (3) Wheat plus a salt mixture * which gave it a mineral content similar to milk. Very little growth. (4) Wheat plus butter fat. No growth. (5) Wheat plus protein, plus the salt mixture; good growth for a time, few or no young, short life. (6) Wheat plus protein, plus butter fat; no growth, short life. (7) Wheat plus the salt mixture, plus butter fat. Fair growth for a time, few or no young, short life.

After all these failures, conducted with critical care, came the 8th and very important and final experiment: wheat, plus protein, plus the salt mixture, plus butter fat; result, good growth, normal number of young, good success in rearing young, life approximately the normal span.

McCollum and Davis thus reached the conclusion that the only element of mystery in the normal diet (No. 8) was the unidentified substance in butter fat. From these experiments two new facts in nutrition emerged:

(a) The inorganic content of the wheat kernel, although it furnishes all the necessary elements, does not contain enough of certain of these to meet the requirements of a young animal during the growing period.

(b) The wheat kernel is too poor in its content of the unidentified substance which butter fat contains to nourish satisfactorily an animal over a long period of time.

It was later a great surprise to McCollum and Davis to find that polished rice, even when supplemented with purified protein, butter fat and a salt mixture, failed to

* By "salt" is meant suitable salt mixture, such as calcium carbonate (chalk from bones and shells), magnesium carbonate (a carbonate is any salt formed by action of carbonic acid), sodium carbonate, potassium iodide, potassium carbonate, phosphoric acid, hydrochloric acid, manganese sulphate, sulphuric acid, citric acid, ferric citrate, sodium fluoride, potassium aluminum sulphate.—"Vitamins, Essential Food Factors," by Benjamin Harrow of Columbia University (Dutton's, 1921).

produce growth in young rats.[1] Not only did they fail to grow but in some cases developed a state of paralysis suggestive of polyneuritis (inflammation of nerves). But it was found that the addition of wheat embryo or milk sugar in as small a quantity as 2 per cent of the food mixture supplied the missing ingredient needed to induce growth. Starch was experimentally substituted for this milk sugar. This slight change made the difference between success and failure. No growth could be secured when the milk sugar was omitted.

The experimental feeding method described above was later applied to other important seeds and to leaves, tubers and roots, as well as foods of animal origin. It consisted in feeding to one group of animals a natural food as the sole source of nutriment, and to other groups the same food supplemented with additions of purified foodstuffs. The interpretation of the results was based on the number of food factors which had to be improved before growth could take place, and the number which when so improved made a better diet as revealed by improved fertility, success in rearing young, span of life and general well being.

As a result of their experiments McCollum and Davis in 1915 set out what they recognized as an adequate diet. This must contain, in addition to the long-recognized dietary factors, in the form of protein, carbohydrates and fats, certain inorganic salts and two as yet unidentified substances or groups of substances. One of these is the fat-soluble A (or vitamin A) because it is found associated with certain fats, being specially abundant in butter fat, egg yolk fats, cod liver oil and the fats of the glandular organs, such as the liver and kidneys, but is absent, or present in but traces, in fats or oils of *vegetable* origin. The second substance, water-soluble B (or vitamin B), is never associated with fats or oils but is widely distributed in natural foods and can be isolated in a concentrated but not pure form from natural foodstuffs by extraction with either water or dilute alcohol. This water

[1] "Purified protein," protein that has been isolated from material containing it and in a state of purity when used, as casein of milk.

or alcoholic extract always contains the substance that cures polyneuritis (beriberi).

To show the nutritional value of each vitamin, and that one is not the equivalent of another, but that food should be so selected that each may be consumed in proper quantity in the course of the meal, the vitamins will now be taken up in the order of their alphabetical names.

Vitamin A

The characteristics of this vitamin are very little known. Numerous experiments have been carried on for the purpose of concentrating it from vegetables and grasses. The finding of McCollum, Simmonds and Steenbock that fat-free skimmed milk still contains Vitamin A has been confirmed. When steam is passed through butter for 2½ hours the vitamin was found by Osborne and Mendel to be unaffected. It has been found that in the destruction of vitamin A oxidation (combining with the oxygen of the air) not temperature plays the chief part. Butter has been found stable when steam was passed through it but not when the butter was heated in the absence of water. The stability in this case may be explained by the replacement of air by steam although even dry butter could be heated at 96° centigrade (about 203° Fahrenheit) for 15 hours without noting any loss of activity. Cod liver oil contains 250 times as much vitamin A as butter and 3 milligrams of this oil per day (less than 1/7th of a drop) is sufficient for rats. Vitamin A occurs only in small amounts in seeds but during the process of germination it appears in greater quantities. Green leaves, Funk says, have been found to contain this vitamin under the influence of sunlight. It has also been found that the inner white leaves of cabbage are free from vitamin A while the outer green leaves contain the substance.[1]

Osborne and Mendel found that the dry matter of tomato or of green leaves, such as spinach, contains an even higher concentration of vitamin A than does butter

[1] Casimir Funk, associate in Biological Chemistry, College of Physicians and Surgeons, New York.

fat. Cooper has reported the presence of vitamin A in orange peel; and Osborne and Mendel have demonstrated its presence in the peel-free juice of the orange. In general it seems that cod liver oil, milk in all forms, beef fat, cream, egg yolks, butter, spinach (in particular), green vegetables and alfalfa are the food sources richest in vitamin A.

Definite conclusions as to the destruction of the vitamins by cooking and preserving processes have not yet been reached. Under ordinary conditions the belief seems to be warranted that such losses are not likely to be large. Steenbock and Boutwell found no demonstrable loss of vitamin A, when chard (Swiss lettuce), carrots, sweet potatoes, squash or yellow maize were heated for three hours under 15 pounds steam pressure at 120° centigrade (248° Fahrenheit). McCollum and Davis report a high vitamin A value in canned evaporated milk (1918) and the same has been found to be true of ripened cheese.

The list of deficiency diseases attributed by Funk and McCollum partly or wholly to the lack of this fat soluble A is limited so far to a form of eye disease in the lower animals largely confined to the conjunctiva (membrane of eyes and lids); rickets (softening of the bones in small children); pellagra, surmised, not yet demonstrated (characterized by grave gastro-intestinal disturbances and skin eruptions, common in the South where there is a deficiency of milk); infantile scurvy, "recognizable"; sprue (a form of small mouth ulcers—thrush,) under suspicion.

The most formidible and interesting of these diseases from a popular standpoint is infantile scurvy. Of 356 cases of scurvy in infants reported to the American Pediatric Society (relating to children's diseases) in 1898, the following table is constructed, as to their diet:

Raw cow's milk,	alone in	4	cases
Breast milk,	"	10	"
Pasteurized milk,	"	16	"
Condensed milk,	"	32	"
Sterilized milk,	"	68	"
Proprietary infants' food		214	"

Some experimental data leave no doubt that scurvy is a deficiency disease resulting from the lack of a specific

chemical substance in the food. This substance is not essential to all mammals, but is indispensable to man, monkey and guinea pig (McCollum) and apparently also to swine and many other species (Plimmer).

On the subject of pellagra Voegtlin practically demonstrated at Spartansburg, S. C., in 1914, in over 100 patients in a pellagra hospital, who were not improving or gradually growing worse on a wrong diet, that prompt improvement would follow the addition of a diet rich in milk (increased 2500 per cent), fruit juices and proteins. The wrong diet was as follows:

Wheat bread	300	grams	Pork	50	grams
Butter	30	"	Potatoes	150	"
Cabbage	100	"	Prunes	30	"
Corn meal	50	"	Turnip tops	100	"
Ham	25	"	Sugar	40	"
Hominy	75	"	Milk	40	"
Corn syrup	75	"			

The corrected diet with greatly increased milk was as follows:

Wheat bread	30	grams	Orange juice	100	grams
Butter	45	"	Potatoes	150	"
Corn meal	50	"	Prunes	30	"
Eggs[1]	100	"	Sugar	40	"
Meat	100	"	Milk	1,000	"

The old cases showed gradual improvement, ending in a large percentage of cures. Another group of new patients put on the corrected diet from the start showed definite improvement within two weeks, while within two months all had recovered except a few far-advanced cases.

Vitamin B

The health-promoting qualities of this vitamin have been much more clearly established than those of vitamin A. Absence of vitamin B causes loss of appetite, cessation of growth in the young and symptoms resembling those of beriberi. It may also include the *bios* (life) which stimulates the growth of yeast. Birds fed on pol-

[1] Ruled out by Kellogg in favor of egg yolks (Chaper XLIX).

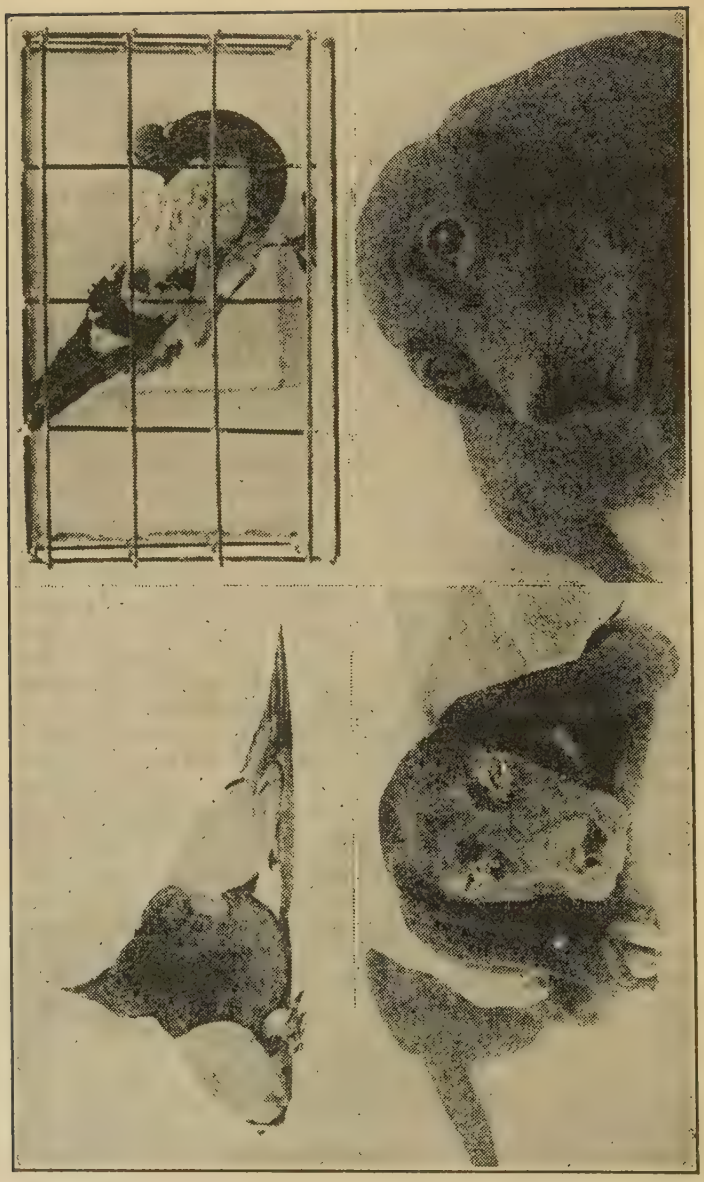
ished rice, or the corresponding products of other grains, develop multiple nerve inflammation due to the lack of vitamin B. In mammals (the highest class of animals, including man) this lack causes loss of appetite with derangement of the organs of digestion and assimilation, disordered endocrine (glandular) secretions and malnutrition of the nervous system. A partial deficiency in this vitamin leads to impaired growth and a general undermining of health and vigor. This lowered vitality may have a far-reaching effect in its influence on reproduction and successful rearing of the young. While the rationale (reason) of the physiological action of vitamin B is obscure and often referred to as growth-promoting (which is one of its qualities) it should be emphasized that this vitamin is essential to normal nutrition at all ages.[1]

The principal food sources of Vitamin B are egg yolks, the whole grains of the cereals, entire wheat flour, beans, peas and seeds in general when eaten whole, rutabagas (Swedish turnip), beet leaves or stems (50 per cent richer than beet roots), raw, canned or dried tomatoes, cabbage (fresh raw), wheat middlings, yeast and yeast extract. It also occurs in moderate percentages but still in good supply in barley, white and yellow cornmeal, oats, rice (not polished, containing the outside layer), rye, bran, fish roe, liver, kidney, brains, grape fruit, lemon juice, orange juice, cabbage (boiled 25 minutes, young 20 minutes), cabbage (raw), carrots, cauliflower, dandelion greens, egg plant, dried lettuce, onions, parsnips, white potato, boiled 15 minutes, white potato baked, turnips, Brazil nuts, cocoanut, filberts, hickory nuts, peanuts, walnuts, milk, dried milk (whole), buttermilk, cream.[2] The reader will remember the important opinion expressed elsewhere by McCollum that the two highly essential foods are embraced in a quart or more of whole milk a day for an adult and plenty of the leafy vegetables, particularly spinach. He calls these two the "protective foods."

Vitamin B is relatively stable to oxidation and heat. The results of experiments by Chick and Hume suggest that little heat destruction will occur in ordinary

[1] Digested from Sherman and Smith.
[2] Same and Casimir Funk.

The ration of these two rats from the same litter was identical from the date of birth, except a change in the form of fat fed. The smaller one was given 5 per cent of sunflower seed and oil. The larger, 1½ per cent of butter fat. Butter fat, egg yolk fats and the leaves of plants contain a dietary essential, the chemical nature of which is still unknown, which is necessary for growth or maintenance of health. This substance, known as fat-soluble A, is not found in vegetable oils. Its absence causes the development of a peculiar eye disease called xerophthalmia. (From *The Newer Knowledge of Nutrition,* E. V. McCollum, Ph.D., Johns Hopkins. Courtesy of The Macmillan Company.)



On the opposite page the dog with eye disease (ophthalmia) was fed food deficient in *vitamin A*. The other dog picture is of the same animal cured in 10 days by the addition to his diet of about one-third of a teaspoonful of cod liver oil a day. (Courtesy of Professor Steenbock of the University of Wisconsin and the *American Journal of Physiology*.)

The prostrate pigeon was given food deficient in *vitamin B* (polished rice). In the cage is seen the same pigeon 24 hours later after 15 grains of smoked ham had been eaten. (*Bulletin 1138, U. S. Department of Agriculture*.)

cooking during which, if loss occurs, it is more likely to be on account of the solubility to water and loss by extraction if the cooking water is not used than through instability to heat at cooking temperatures. Vitamin B is the most stable of the vitamins.[1]

The effect of heat on vitamins is not yet a settled question but the most authoritative information is that it is immaterial under ordinary cooking conditions. A contrary view has been exploited by non-scientific commercial producers of so-called vitamin extracts, although this lately-discovered food accessory has never yet been identified, let alone extracted. There are plenty of vitamins for all in ordinary food. A typical instance of misrepresentation on this point is the widely-printed statement that vitamin A is destroyed at 100°. The fact is that H. Steenbock of the laboratory of Agricultural Chemistry, University of Wisconsin, states that the butter fat vitamin was completely destroyed at 100°.[2] This 100° means 100° Centigrade (212° F.), or the boiling point of water. But the butter fat was manipulated by being shaken in water and the water separated from the fat in a vacuum. The fat was then found inactive. Butter fat through which air had been passed at the same temperature was also found inactive. But elsewhere in this book the fact has been distinctly set out that where air is allowed to pass through a cooking substance the vitamin content may be greatly reduced by uniting with oxygen of the air (oxidation). Osborne and Mendel say that butter fat through which live steam was passed for 2½ hours did not lose its growth-promoting properties. But heated by Steenbock in jars at 100° Centigrade in the dry air of a Freas oven the butter lost its activity. The explanation of these apparently conflicting statements was set forth separately but simultaneously by Hopkins of Cambridge University Laboratory (England) and by Drummond and Coward of the Institute of Physiology, University College, London, in the same Journal, and same issue.[3]

[1] Proceedings Royal Society of London, Series B. 90.
[2] *Journal of Biological Chemistry*, 1916.
[3] *Biochemical Journal* (England), Vol. 14 (1920), pp. 665 and 725.

The conclusive result can now be stated to be that the effect of a high temperature on vitamin A in butter is nil if the air is excluded by a lid. If the air is freely admitted at an exposure for 4 hours at a temperature of 120 C. (248 F.) it destroys the greater part of the vitamin vitality, and exposure to the same condition for 12 hours would seem to result in almost complete destruction.[1] Four samples of butter were maintained at a temperature of 37° C. (body heat) for three weeks. Two of these were exposed to the air and two protected from the air in stoppered bottles. The samples exposed to the air became bleached, that exposed to the light almost completely so, and both lost their power to restore growth to rats. The samples not exposed to the air remained unimpaired.[2]

The heat-resistance power of butter fat is an academic question, as butter eaten for nutritional purposes is practically always eaten cold. The same can be said of milk, raw fruits, sliced tomatoes, salads, cream and nuts.

The effect of heat on milk is set forth by Anderson, Dutcher, Eckles and Wilbur of the Minnesota Experiment Station.[3] It was found that milk heated to the boiling point was practically equal in nutritive properties and anti-scorbutic (scurvy) potency of unheated milk, provided it was kept in an undisturbed condition. Pasteurized milk heated to 145° F. for 30 minutes quickly lost its potency because it had been stirred rather violently wth motor-driven propellers, while the milk heated to the boiling point had not been stirred. It has now been demonstrated that under conditions of agitation a destructive influence is exercised on the milk vitamin by oxygen, one of the free elements of air.

Tomatoes, both raw and cooked, are an excellent source of vitamins both B and C and also of A in a slightly lesser degree. Hess and Unger[4] obtained good results

[1] Hopkins.
[2] Drummond and Coward.
[3] *Science* (N. Y.), May 6, 1921.
[4] Personal communication to the authors by Alfred F. Hess (frequently quoted as an authority) of the Bureau of Laboratories, Department of Health, New York City.

with canned tomatoes in the prevention and treatment of experimental scurvy in guinea pigs. They also fed canned tomato to infants, substituting it for orange juice, and found that 15 cubic centimeters (tablespoonful is 16 c.c.) per day were well tolerated by infants over three months of age. They recommend this as an economical and efficient anti-scorbutic for children. Tomato, on account of its acidity, will stand heating at the boiling temperature without any loss to its vitamin B content, either fresh or canned. Its lesser vitamin content is also immune to destruction at the same temperature if oxidization is prevented. *Vitamin B in all its sources has so far been found resistent to cooking heat under the same conditions of non-exposure to air.* This important vitamin is widely distributed and everybody can get plenty of it. But in cooking a number of authorities point out that the destruction of the vitamin content of any vegetable is facilitated by adding soda to the water, as some cooks do to make the vegetable greener.

Vitamin C

The isolation of the anti-scorbutic (anti-scurvy) substance presents greater difficulties than with the vitamins A and B. C is more easily destroyed by oxidation, heating, drying and other processes.

The action of heat on the *anti-scorbutic* value of vegetables and fruit juices has been carefully studied by Miss Delf at the Lister Institute, London, with the following results:

Cabbage heated in water at 140° F. for 1 hour loses 70% of its value.
At 158-177° F. for 1 hour loses 90% of its value.
At 194° F. for 20 minutes loses 70% of its value.
Cabbage juice heated at 212° F. for 1 hour loses 80% of its value.
Swede turnip juice heated at 212° F. for 1 hour loses 50% of its value.
Orange juice and lemon juice at boiling point for 1 hour. No apparent loss.

Like vegetables, milk suffers less loss of this element on boiling for a few minutes than by a gentle heat-

ing for longer periods. Hess has found that milk loses much of its anti-scorbutic value by excessive handling during transit from the cow to the baby. Many of the processes in the dairy involve the exposure of large surfaces of milk to the air and the frequent pouring of milk from one container into another.[1]

Orange juice is an excellent anti-scorbutic and when boiled and rendered slightly alkaline is properly used in infantile scurvy as an intravenous injection (within veins), but in such cases the juice should be used immediately and not kept in the alkaline condition.[1]

The same authors found that modified milk mixtures containing malt soup were especially prone to bring about scurvy in infants. This was traced to the practice of adding alkali (such as soda) to the malt soup where it exerted a deleterious effect on the anti-scorbutic vitamin of the milk.

Cooking cabbage at 230° F. for ½ hour did not entirely destroy its anti-scorbutic qualities. Berries after cooking retained their efficiency to a very large extent. Raspberry juice was not injured by heating to the boiling point for one hour. Injury from cooking was less when air was excluded.[2] (Do not associate the above facts with vitamin B.)

Harden and Robison [3] say that apple juice concentrated to about 1/6 of its original volume forms a palatable jelly of distinct anti-scorbutic (scurvy) properties. The general use of fruit jellies prepared by this or a similar process is recommended as a substitute for ordinary jams or jellies, wherever there is reason to suspect that the diet is deficient in the anti-scorbutic vitamin C. If evaporated by the slow process of boiling there should be as little air movement as possible. Sugar can then be added. Open evaporation, instead of in the Kestner evaporator (as above) results in a considerable loss of vitamin vitality.

So far as fruits and vegetables are concerned the de-

[1] Hess and Unger, "Proceedings Society of Experimental Biology and Medicine," V. 15.
[2] Plimmer, Halst and Frölich quoted by Sherman and Smith.
[3] *Journal Royal Army Medical Corps* quoted by Sherman and Smith.

gree of ripeness at which the fresh fruit is most prized will probably approximate that at which it has the greatest vitamin value.[1] Onions, stems of asparagus, celery, cabbage, lettuce, cress and spinach are all classed by numerous authorities as anti-scorbutic. Scalded milk loses about half its vitamin C value.[2]

Kellogg[3] says unfermented apple juice is exceedingly wholesome. It is a highly valuable remedy in gastric and intestinal catarrh, so-called biliousness, jaundice, constipation and in cases in which the kidneys and the liver are disordered; in emaciation, loss of appetite and general malnutrition. It may be taken up to a quart a day with advantage, preferably *one-half hour before each meal.* The proper way to preserve cider made from clean, selected apples is to heat to 165° F. for fifteen or twenty minutes. This will kill all fermentation germs. A higher temperature impairs the quality. The addition of benzoic acid as a preservative agent is highly objectionable. Bottled cider preserved by the above formula can be kept throughout the year and is as good as the natural cider, as the writer can attest.

As to the vitamin value of apples, raw, dried and cooked, Givens, McClugage and Van Horn of the Department of Physiology, University of Rochester, N. Y. report that 10 grams of raw apple or banana will protect a guinea pig against scurvy for three months. The use of these foods is advocated by Myers and Rose not only for healthy adults and infants but for the sick.[4] The U. S. Department of Agriculture points out, however, that there is a great difference between the digestibility of winter apples fresh from the trees and those that have had a month or two to ripen—a fact well known to experienced apple eaters. During this early period fall apples like Grimes' Golden should be eaten.

The deduction, therefore, seems warranted, although no express authority can as yet be found for it, that the juice of the apple as preserved by heat to 165° F. and kept corked has the same moderate vitamin A, B, and C,

[1] Sherman and Smith.
[2] Barnes and Hume, London *Lancet*, 1919.
[3] "New Dietetics."
[4] *Journal Am. Med. Association*, 1917, V. 48.

value as the raw apple, while such cider performs an important function as a part of the regular diet.

Vitamin D.

In his last work Funk observes that we must ask the question whether, with enumeration of the above three vitamins, we have exhausted all the possibilities. Hardly had Funk's book been published when Dr. E. V. McCollum of Johns Hopkins announced (June 18, 1922) the discovery of vitamin D, concerned with bone growth.

McCollum and associates destroyed the vitamin A by oxidation, and made cod liver oil incapable of preventing the eye disease, but without diminishing in a noticeable degree its value for the prevention or cure of rickets, and thus showed that certain fats contain *two vitamins*, one related to the functioning of the nutritional processes of the eyes, the other concerned primarily with the utilization of calcium and phosphorus in bones.

On the last day of December, 1923, before the American Association for the Advancement of Science, Prof. Lash Miller, of the University of Toronto, announced that in experimenting with an infusion of malt (wort) he had split off two new compounds which he had named Bios 1 and Bios 2. More than 50 vegetables and animal substances were studied and the bioses were found as widely distributed as vitamin B. Mushrooms and white of egg contain more of Bios 2. The power of this compound in promoting growth is marvelous. If 1 part of bios is added to 25,000 parts of a fermenting mixture the yeast plants grow ten times as fast as normal in a day.

March 19, 1924, Dr. Walter H. Eddy, of Columbia University, announced the isolation of Vitamin D. Four crystalline specimens of the isolated vitamin were exhibited to the audience. The composition was announced as 43 per cent carbon, 25 per cent nitrogen, and 8 per cent hydrogen, the remaining 24 per cent not then accounted for. (It will be noted that protein, a very complex organic substance, is composed of carbon, hydrogen, nitrogen and oxygen.)

Chapter XXIII

THE OUNCE OF PREVENTION

People under five and thirty should keep sharp eyes on their intestinal mechanism. No study is better repaid. In the case of young women the element of good looks also enters into consideration because they are casting an anchor to windward against a pallid and unhealthy skin, with its occasional accompaniment of pimples and various other blemishes.

Young people react favorably and promptly to simple remedies that are worthless to those of advanced years. The reason is youth has strength; age, weakness. Also youth has not committed the sins of omission and commission against health that can be charged up against the great majority of the aged. The musculature of the great intestinal tract in youth will make a quick response to intelligent treatment, whereas in age the abdominal viscera are not only frequently prolapsed (fallen) but have become weakened and misshapen.

So that a youth who is experiencing early difficulties with the digestive tract must at once address prompt attention to the cause and the remedy. Neglect, indifference and ignorance at such time will later exact a heavy penalty.

If youth will again consider the life of primitive men certain interesting and instructive facts will be discovered. They not only live night and day in the open but eat coarse food of few varieties. The modern dietary, especially of the wealthy, is adapted to the palate rather than the digestive organs. Rich desserts, pies, cakes, marmalades, meats, gravies and dressings of various kinds are the rule, while with it often goes an indolent existence and bad ventilation. Primitive men not only

live in the open but they are almost continually on the move, stooping to pick up things, thus exercising their abdominal muscles hundreds of times a day, throwing stones, climbing trees, running so that they breathe hard and deep, and lying down at night in the open with tired muscles to sound sleep.

When young people of 20, 30, or even 40 years of age find themselves with headache, frequent colds, coated tongue, lack of appetite, weakened efficiency and more or less constant attacks of constipation, the first course to be pursued, according to leading authorities, is to simplify the diet and promptly adopt the proper regimen given in detail elsewhere. The 3 glasses of water in the morning are generally sufficient. An examination of the abdominal muscles will probably find them flabby. In this condition they lack the necessary propulsive power for the act of defecation. This is one of the most important facts in abdominal physiology and is repeatedly called to the attention of the reader in several chapters of this book by the most eminent authorities.

The groundwork for the above conditions in the young is nearly always to be charged up to poor parental supervision during childhood. Fothergill says the girl needs a well-developed chest, vigorous limbs and healthy abdominal organs just as much as the boy. And how is she to get them without exercise? You may as well expect her to be educated without lessons. As a medical man our author expresses a certain mistrust of the neat little girl who never soils her clothes. She is very nice to look at; her mother is naturally proud of her; she will do very well for a picture; but she is not suited for the battle of life. She is not a healthy young animal as she ought to be. She is angelic and will soon be with the angels is the forecast of the physiologist. Says the mother: "I see all this quite clearly but I cannot allow my daughter to grow up a tomboy." But conventionality is put away at the seashore where children are expected to romp in the sun and dig in the sand. The skipping rope, basket ball, the long walk, the romp and the swing are all available, the last for

even big girls. In the many years Fothergill was attached to the London Hospital for Diseases of the Chest he says he had it burned in on his experience and memory that great danger underlies the flat, narrow chest in any disease of the lungs, especially in tuberculosis. Such lungs in health are barely sufficient for the needs of the organism. When invaded by disease the fight becomes a hopeless one. Insist on the development of the chest to the uttermost during the period of growth. Start a contest between the children. Carefully keep a record of chest measurements. Set a goal. Offer a prize when the expansion reaches 3 inches, 3½ inches, 4 inches, 4½ inches. Encourage emulation of those who have a good chest expansion. Make it a matter of frequent observation.[1]

Of young women our author says no one is more in need of information than they. Unless a girl is obviously in ill health and the doctor sent for, no attention is likely to be paid to matters which every experienced physician knows to be of cardinal importance.

[1] Digested from "Diseases of Sedentary and Advanced Life," by J. Milner Fothergill, M.D., late physician to the City of London Hospital for Diseases of the Chest, New York, D. Appleton & Co.

Chapter XXIV

THE GREATEST MENACE OF ALL

Field says he is continually surprised at the mistake people make as to the completeness of defecation. This error is frequently practiced regularly by persons who are very particular as to personal cleanliness in all other matters. It is almost a regular experience to find in cases of stasis located in the lower end of the colon (dyschezia) that from one-third to one-half of the contents that should be expelled are left behind.[1]

No curiosity as to the facts seems to exist. Not the least attempt is made to secure any accurate information on the subject. Nor is it even known that the act of defecation when properly performed should empty the colon as far up as the splenic flexure,[2] (end of the tranverse colon). Whether this has been done or not can be easily and accurately ascertained by a follow-up irrigation of the descending colon as far as this flexure, and the frequent use of charcoal "markers" (discussed later).

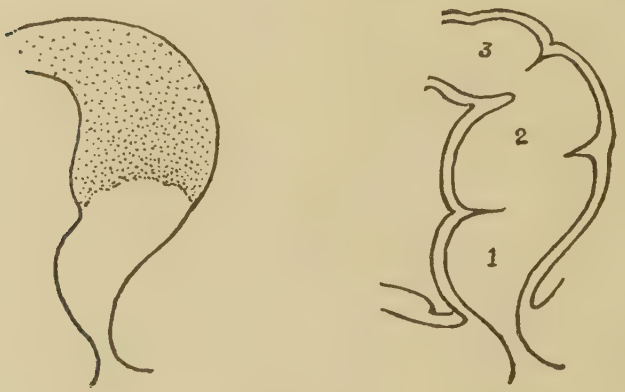
As these residues accumulate they become impacted, lose much of their moisture, become dark in color, produce a loss of appetite (nature's protest against the condition) and, by deranging the delicately adjusted intestinal mechanism of nutrition, bring about a general condition of inefficiency and ill health, fully discussed elsewhere.

After a patient has suffered from this intermittent or persistent condition, whatever the cause, mucus will promptly make its appearance, usually in jelly-like form

[1] Henry M. Field, late professor of Therapeutics at Dartmouth Medical School, in the Boston *Medical and Surgical Journal.*

[2] "Mechanical Factors of Digestion," by Walter B. Cannon, professor of Physiology at Harvard.

around the scybala (hard masses). Although this is often considered the beginning of the catarrhal stage, there can be no doubt that catarrh will exist long before the mucus becomes visible. For a time the patient may now suffer from alternating constipation and diarrhea, with occasional distension of the bowels and flatulency, the diarrhea, according to Ewald, being produced



A. Rectum of girl aged 13 who habitually had incomplete defecation, emptying only the lower part as represented by the white section of the drawing.

B. Interior of rectum, showing chambers, 1 and 2. The upper section, 3, is the lower end of the pelvic colon. (After Jordan.)

by fermentation. At this stage scybala are apt to accumulate in the colon, especially at the flexures, and, setting up irritation of the membrane, cause a marked increase in the quantity of the mucus secreted.[1]

Gompertz, in order to ascertain the efficiency of bowel movements in healthy young men, developed an important and interesting experiment. He gave 10 grains of lampblack to 30 individuals, all students but two, one of the two being a merchant aged 32 and one a phy-

[1] Louis M. Gompertz, M.D., clinical instructor in gastro-intestinal diseases in Yale University; gastro-enterologist to the Hospital of St. Raphael, New Haven, Conn.

sician aged 36. In ten of the cases selected as being indicative of the whole body the lampblack was identified in the following number of hours after ingestion: 11, 13, 15, 15½, 13½, 14, 14½, 13, 13½, 14½. In six cases it was taken in the morning and in four in the evening. The average time was a little over 13½ hours.[1]

It would be very instructive had Gompertz carried the investigation into the fourth, fifth, sixth, seventh and eighth decades of age. The results would in all likelihood have shown a progressive lengthening of the time between ingestion and defecation. With the progress of age, the lessening of physical activity, the decline in strength, the decrease in the amount of exercise, the frequent maintenance of the full-sized food ration and, most important of all, the weakening of the abdominal muscles, there develops in a large majority of cases a marked impairment of the intestinal functions.

Hurst says that the majority of cases of stasis, so often associated with visceroptosis (falling of the organs), is due to weakness of the abdominal and pelvic muscles and the ptosis (falling) of the diaphragm, which render the act of defecation inefficient, so that the rectum and pelvic colon are never properly emptied.

What this very frequently means may be best shown perhaps by the citation of a case reported by Stevens.[2]

Mrs. H., beyond middle age, applied for relief from "rheumatism"—that is, she complained of pain in her shoulders, arms and legs, and this had continued for about four years. Because of an accident to her husband the burden of family support had fallen on her. For two years she had suffered from cold feet and during this period she lost about twenty pounds. Her throat and teeth were in good condition with no inflammatory skin affection. She had considerable flatulence, her complexion was bad and where she formerly had a clear and ruddy skin her face became sallow and careworn.

She was directed to take three 5 grain charcoal tablets at 9 o'clock in the evening and thereafter to note the color

[1] Same.
[2] Edward S. Stevens, M.D., New York City, in the *Woman's Medical Journal*, May, 1917.

of the stools. She had been habitually using laxatives. Her report follows:

At 14 hours,—the usual color
38 hours,—slightly darkened
62 hours,—color increased
86 hours,—quite dark
110 hours,—color lighter
134 hours,—slight color
158 hours,—usual color

It will be noticed that the color persisted for ten hours less than six days, and it probably persisted longer, as there was no observation between 134 and 158.

At a clinic (examination of a patient in the presence of a class) in a western medical college of prominence, duly published, the lecturer observed that four days between ingestion and ejection is about normal. This astonishing statement coming from an instructor is valuable as showing the unreliability of even medical opinions and as also disclosing a condition that is sufficiently widespread to seem to warrant such a generalization. We also have here a probable explanation of the reason many people stop too soon in taking agar and bran.

Numerous authorities of the highest competence have accurately observed and carefully noted the normal time required for the disposal of the dejecta of the human body.

Hurst says the x-ray examination of eighteen normal individuals disclosed that the barium meal reached the cecum in from 3½ to 5 hours (beginning of the colon), the hepatic flexure (the first bend) in from 5 to 8 hours, the splenic flexure (end of the transverse colon) in from 7 to 14 hours and the junction of the descending colon with the iliac colon (at the crest of the pelvis) in from 8 to 16 hours. The average time taken is 4 hours to the cecum, 6 to the hepatic flexure, 9 to the splenic flexure, 11 to the commencement of the iliac colon (sigmoid) and 12 to the pelvic colon[1] (lower part of the sigmoid).

[1] "Constipation," 1919.

The same author also calls attention to the well-known fact that the rectum should always be empty except at the time when there is a call of nature, at which time it has been supplied with dejecta from the adjoining pelvic colon* (see page 50). The act should then be complete at least as far as the splenic flexure and sometimes beyond that point. There is no more important fact of colon hygiene than this. (See page 39.)

The average American citizen, says Kellogg, considers himself a model of regularity if he has one bowel movement daily without the use of drugs. But it is no exaggeration to say that the said average adult is suffering from intestinal toxemia (poisons generated in the intestine). Women suffer more than men. It is difficult to find one who does not show more or less indications of this condition (thus confirming Foges of Vienna, quoted elsewhere). When the bowels move thoroughly three times a day the food residues remain in the colon too short a time to allow for the development of advanced putrefaction. If the diet is low in protein (food derived from animal sources, exclusive of milk), rich in carbohydrates (starches, sugars, preferably other than cane, such as honey and grape sugar), the output soon ceases to show marked evidence of decomposition, the strong ammoniacal, putrid or rancid odors disappear, the odor becomes either faint, sweetish or slightly sour, while the dark brown color gives place to a color nearer the orange.

Constipation is a disease of civilization. Wild men and wild animals do not suffer from this malady which is perhaps responsible for more human misery, mental and

* It is difficult to find two authorities that give the same figures for the length of the small and large intestine. Eskimos have the shortest and vegetarians the longest. Gray's "Anatomy," an authority, published since 1858, in the edition of 1920, gives the length of the small intestine at about 7 meters (22.96 feet). The large intestine is about 1½ meters long (4.92 feet), the total length thus being 27.88 feet, or over *4 and 3/5ths times the length of a 6-foot human figure.* Of all the wonders of the body, this organ has a quite exceptional wonder in its astonishing length, throughout every inch of which it is ever liable to derangement of some of its delicately organized and highly specialized digestive equipment.

moral disaster, than almost any other cause that can be named.[1]

In every case of constipation some particular condition is the immediate cause of the delayed intestinal movement. In practically all cases this can be readily removed by change of the intestinal flora, increase of the bulk of the food or by other available means.[1]

In colitis (inflammation of the colon membrane) bran is of signal benefit. It is most important that the mucous membrane should be kept clean. Paraffin oil is necessary as a lubricant. Long continued inflammation causes degeneration of the mucous membrane that produces the lubricating mucus. The intestinal flora (microorganisms) should be changed and the membrane kept clean by a laxative diet, if necessary by the daily use of the enema.[1]

When the bowels are once regulated be careful not to interrupt the rhythm. Make no experiments. Keep right on doing the things that succeed.[1]

Eyre, quoted by Mutch, examined bacteria from the lower end of the small intestine, near its union with the cecum, in 16 constipated patients. In one only there was a failure to find disease-breeding (pathogenic) microorganisms. When the valve separating the small from the large intestine (ileo-cecal) is passed conditions become much worse. On 15 occasions Mutch attended upon operations by Sir Arbuthnot Lane for removal of parts of the colon and small intestine in bad cases of intestinal stasis and made careful notes. When the small intestine was opened an extremely faint fecal odor was emitted. But when the cecum (beginning of the large intestine) was cut into there was very pronounced, nauseating odor, indicating bad conditions of putrefaction in the large intestine.[2]

What infections under such conditions may mean is set out by Reed who says that the terms "insanity" and "epilepsy" are vague and refer simply to various conditions induced by the poisoning of the blood stream

[1] Same.

[2] Nathan Mutch, M.D., of the Guy's Hospital Laboratories, London, author of two chapters of Lane's "Intestinal Stasis," in the *Quarterly Journal of Medicine* (English), July, 1914.

by "focal" infections of one kind or another (meaning sources of infection). He defines these infections as invasions of the body by disease-producing germs which, becoming established in a tissue, organ or cavity, there form a focus from which the germs themselves, or the toxins they generate, or both, are persistently absorbed into the blood stream and thus infect the general system.[1]

Under this lucid generalization who can say that the common infections of the tonsils and teeth do not frequently originate in the intestinal tract? Reed shies at the definitions of insanity" and "epilepsy." This recalls the remark of John Hunter, the great British physiologist and surgeon (1728-1793), that "of all things on the face of the earth definitions are the most cursed," meaning, no doubt, that they are often allowed to take the place of a rigid investigation of the facts.[2]

For instance, it is not difficult to define the phrase "tobacco heart" as being due to excessive smoking. But Brooks, as is shown in Chapter XXXI herewith, was not content with generalities and made 54 post mortems where death seemed to be associated with excessive use of tobacco, and reached certain definite conclusions that seem to rest on the facts instead of on definitions. Such observations apply, as Hunter points out, with more force to the physician than to the layman, as the public is slowly finding out at its cost.

[1] C. A. L. Reed, a leading surgeon, Cincinnati, ex-president of the American Medical Association, in the Cincinnati *Journal of Medicine*, 1922.

[2] John Hunter, "Lectures on the Principles of Surgery," Palmer edition, Philadelphia, 1839, p. 16.

Chapter XXV

INTELLIGENT USE OF THE ENEMA

There is no dictum in medical literature more common than the advice that the enema is a device that should be resorted to as a temporary expedient only, and that the same rule applies to the use of any laxative medicine.

This is believed by some excellent authorities to be ill-considered advice as to enemas, based on too few or inaccurate observations.

In chronic cases of constipation, especially when associated with the physical weakness of advancing years, how can relief be secured from a temporary use of any method as long as the cause is not removed? The cause is frequently *muscular weakness of the abdominal walls and of the intestine* and general debility. If the vigor of those parts of the body be restored by the methods set forth elsewhere, then there may be hope based on experience, of securing relief from the temporary use of medicines and irrigation of the bowels. On any other theory it seems idle to talk or write about the temporary use of relief measures.

The use of the enema is a wise measure in a large percentage of cases if properly guarded from abuse. Too frequently the patient has a profound ignorance not only of the anatomy of the parts, and their reaction to treatment, but has no idea of the location of the trouble.

As Hurst has shown, there are two general forms of constipation. The first is associated with the passage of the residue of the food from the cecum to the pelvic colon (that part situated in the left pelvis—sigmoid flexure) and the second with the complete evacuation of

this pelvic colon at proper intervals. In the first class the passage through the intestine is delayed whilst defecation is normal; and in the second class there is no delay in the arrival at the pelvic colon but excretion is not properly performed. In the last edition of his book, 1919, the author adds a third class in which the colon content is not full enough to produce an adequate stimulus to these processes. The names applied to the first two types are respectively colic (colon) constipation and dyschezia.[1]

Case says (confirming Hurst) that colon stasis occurs particularly in two places—in the pelvic colon and in the cecum. This is a very important observation by a competent authority who has examined thousands of cases.[2]

If dyschezia is the form with which the patient is afflicted, it is manifest that relief through the stomach should not be expected until the obstruction at the distal (lower) end of the colon is removed. How thorough the irrigation must be to secure such relief depends on the individual case. If the stasis through prolonged neglect extends as far back as the cecum (beginning of the colon), it may take a week or even longer to secure thorough relief from the profound impaction of the contents of the colon.

There are two alternative first steps, or, if both of them are taken, all the better. One is a visual examination by means of the barium meal with the fluorescent screen (sometimes called the fluoroscope), which gives more information than is obtainable from skiagrams (x-ray pictures). With the screen the outline of the colon can be traced on a piece of lead glass over the screen, from which the sketch can be later copied. If a small diaphragm (opening) is used and the tube moved about so as to bring each part of the barium shadow successively into the center of the field, accurate measurements can be obtained from the tracing. Skiagrams, on the other hand, produce so much distortion that they are quite useless

[1] "Constipation."

[2] *Iowa State Medical Journal*, Feb., 1916. See index for biographical note.

if measurements are desired. With the screen, moreover, it is not only possible to locate the exact position of the colon, but generally to palpate (explore on the surface with the fingers) the parts which are seen. By this means their mobility, the presence of adhesions, the exact location of tender areas and the location and condition of the contents can be learned. One of the great advantages of this method is that the patient learns the location particularly of the transverse colon, so that in the use of massage it can be applied at the right place. It is also learned whether there is any permanent contraction of the colon, any falling from the normal position, or any other diseased or abnormal condition that requires attention.[1] If this method is resorted to it is of great importance to go to a competent and conscientious operator who performs this service for physicians, as there are many amateurs in this field who should be carefully avoided. Many of them are not competent, in the opinion of Kellogg, to interpret what they see.

The alternative step is to take a sufficient quantity of charcoal (3 or 4 5-grain tablets) about 4 p.m. and ascertain definitely if it goes through in the normal time, and if not the exact amount of delay. Not only the first but also the last appearance of the charcoal should be particularly noted. If some of the charcoal is not passed at the latest the second morning, the patient must be regarded as having intestinal stasis. If food is taken in the evening about nine hours before defecation, some of its residue is likely to be present in the morning. If taken less than nine hours before, none of it can reach the splenic flexure in time to disclose its presence. It continues to advance until it reaches the pelvic colon (sigmoid) where it remains until the next defecation.[1]

With this information at hand, if there has been not only serious delay but imperfect defecation, the next step is a thorough irrigation of the colon (coloclyster) as far as the cecum, as explained elsewhere.[1]

Coincidentally with this step there should be adopted one of the several laxative food regimens described herein,

[1] Hurst.

the proper abdominal exercises and the inauguration of a change in the intestinal flora, of which all the details will be found in the chapters on those subjects.

In addition to the will to succeed a large majority of the chronic cases will require the help of everyone of these expedients before the crippled colon has recovered sufficient strength to resume its normal functions. And even then there will be a considerable percentage of cases that will require the permanent help of the enema from the splenic flexure down, as a secondary, not a preliminary, act.

To give this in the right way, the knee-chest position, so often advised, should not be adopted. That is only for cases that need irrigation as far back as the cecum. For water to reach the splenic flexure after defecation (it seldom should be used before) it should be introduced (at a temperature of 80°,) in any amount up to two pints, while the trunk is, if preferred, in an upright position, and a recumbent position on the *left side* then assumed for a few minutes. If there is any uncomfortable reaction to the water at the above temperature, which is not probable, the temperature can be raised slightly, even to 99°, as indicated by a therometer dropped into it, slightly above the body temperature. But in such cases a last enema should drop back to 80°, or even lower, in order to give the bowel the tonic effect of the cool water, as it is not uncommon for a considerable and very annoying chronic distention of the bowel to result from too warm enemas.

The reader should note that this plan (of separating dyschezia from upper colon constipation) greatly simplifies the problem. By relieving the dyschezia, which is generally the predominating trouble, by the temperate, but permanent use of the cool enema by the above method as far as the splenic flexure, very often severer measures will not be required. Incidentally other conditions generally associated with intestinal stasis are benefited. If there be chronic constriction of the descending colon the stricture is much more readily passed after softening of the contents. If colitis, (inflammation of the colon), with discharge of mucus, is present the

addition of a dram of salt (a level teaspoonful) to a pint of water with a warm enema, above 90° is indicated. In fact, Hare recommends the addition of salt to all large injections. In the treatment of dysentery he observes that by this means we can get into direct contact with the diseased mucous membrane and there is no doubt whatever that the mere passage of normal salt solution at suitable temperatures over the bowel-wall is of value, for in this manner we remove mucus and pus and so dilute the poisons produced by the germs of the disease that their further action is largely controlled.[1]

Kellogg says that when a cleansing effect is desired, as in catarrh of the bowels, a mixture of equal parts of carbonate of soda (employed internally to meet the same conditions as bicarbonate) and common salt (1½ drams of each to the quart of water) may be used.[2] The slight difference here in the quantity of salt is not material.

When all the aids indicated (including abdominal and outdoor exercises, early morning water drinking, bran, oil, if needed, and proper diet) have been summoned, and there is no condition present requiring the attention of the surgeon, the patient can have every hope not only of permanent relief but greatly improved health with an extended life span. And none of the aids alluded to are anticipatory of anything more than the resumption of a normal life for the colon.

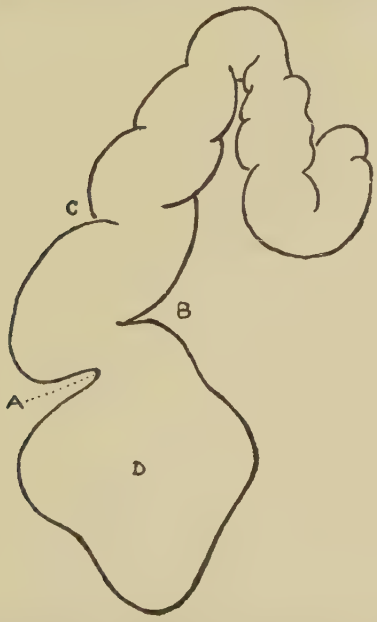
There is eminent authority for the permanent use of the cool enema as far as the splenic flexure in chronic cases of dyschezia given under proper condition and in the proper quantity, not, except under necessity, as an aid to defecation but as an act of cleanliness and health.

Thus Case says that when dyschezia is present it seems unreasonable to administer a laxative which will irritate

[1] If very large injections are used, a normal saline solution of 7:1000 (1 dram to 1 pint) should be employed to avoid the abstraction of vital salts from the intestinal wall, with the consequent passage of water into the tissues, making them boggy, due to the law of osmosis (transfusion of fluids through membranes). If the saline solution is stronger than this it abstracts water from the bowel wall and causes irritation and thirst.—HARE.

[2] "Rational Hydrotherapy," 1918.

twenty-five feet of bowel in order to evacuate the last twelve or fifteen inches of the colon. Here enemas are indicated. A small, cool enema is often enough to produce a thorough evacuation of the lower bowel. In cases where it is desired to evacuate the whole colon and reach the cecum Case says that probably six thousand



Paraffin cast of dilated rectum D, with A, B, C, indentations of the second and third rectal valves, with connecting coil of sigmoid flexure (pelvic colon). After Pennington.

times he and his colleagues have watched by means of the fluoroscope the introduction of the barium enema. Only in instances of organic bowel obstruction has the head of the barium enema failed to reach the cecum within a few moments. The average amount of fluid necessary is 1200 cubic centimeters (a little over 40½ fluid ounces), the container being 2½ feet above the patient. In the light of Case's experience with the coloclyster

(filling the whole colon) it is very rarely that the knee chest position is required, as the resulting distortion of the colon becomes very confusing.[1]

The most important part of the treatment of dyschezia, in Hurst's opinion, is to keep the rectum and pelvic colon empty so that they may in time regain their normal tone. This can be accomplished by the regular use of enemata (plural for enema). Even in the most obstinate cases the ultimate result is often very satisfactory although the enemata may have to be given regularly for a year or longer before the rectum and pelvic colon return to their normal condition. In very exceptional cases the atony (loss of tone) and paralysis of the rectum are so complete that recovery is impossible. In such cases treatment by enemata, though it does not cure, is the only way to procure a regular evacuation. Upon complaint by a nervous patient of exhaustion, or abdominal pain after an enema has been administered, it should be given at bedtime, instead of in the morning, or by the introduction of a belladonna suppository half an hour before the injection.[2]

The cold enema gives rise to strong contractions which are often accompanied by colic. A hot enema cannot be given at a temperature more than a few degrees higher than the body, whereas the cool injection can, on proper occasion, be used without danger. The former is used for its sedative effect or over-activity in cases of colic.[3] It has been said that the regular use of enema is always harmful. *This belief is, however, erroneous, Hurst says. In many cases of dyschezia (impaction at lower end of colon) it is the only means which can result in complete recovery.* Hurst knows a medical man, 71 years old, who has never failed to obtain an easy evacuation every morning for 24 years by means of enemata of three pints of soap and water.[4]

James T. Case in *Iowa State Medical Journal*, January, 1916.

[1] Hurst (before the war spelled Hertz) in Latham and English "System of Treatment," an English publication of excellent repute.

[2] Hurst, "Constipation."

[4] Relying wholly upon such a quantity of water *as a preliminary measure* and as a regular practice should not be necessary when proper accessory measures are utilized.

Hurst says his experiments prove that the true explanation of the failure of the rectum to act with feces present is the *relaxation of tone* which occurs in the muscular coat after it has been subjected to a certain degree of tension for a short period. The call only returns after further material has entered the rectum and produced a rise in *intra-rectal pressure.* This may occur after any meal but most frequently only after breakfast. The theory advanced by some that the rectum empties itself backwards into the pelvic colon in case of non-defecation has been proved by x-ray examinations to be a mistake.

The coloclyster[1] is used in Kellogg's practice when it is desired to fill the entire colon, or at least to introduce the largest quantity of water possible, without over distending the colon. In the ordinary enema, it is difficult to introduce more than a pint and a half to three pints of water; but by placing the patient on the knees with the thighs perpendicular, and the chest within two or three inches of the knee level (knee-chest position) the amount of liquid will flow in freely and may be increased to four, five or six pints, and in some cases to even more, without inconvenience to the patient. The coloclyster is called for in neglected cases where a general colon clean-out is imperative before remedial measures are attempted. In the knee-chest position the water passes downward (owing to the position of the body) through the sigmoid flexure (pelvic-colon) and then runs along the descending colon. On reaching the transverse colon at the splenic flexure (see diagram) it passes across to the hepatic flexure and through it into the first section, or ascending colon, beginning at the cecum, where it accumulates until the colon in its entirety is gradually filled. This complete filling of the colon is necessary in cases in which fecal accumulations are present in the cecum and other remote sections. It is valuable in catarrh of the cecum, a condition often mistaken for appendicitis, and which is doubtless the precursor of

[1] As used here this word means a much larger and more prolonged use of water than in the ordinary enema which is supposed to stop at the splenic flexure.

appendicitis in the great majority of cases; also in cases where the cecum is infested with thread worms and in cases of so-called membranous colitis. The coloclyster also affords marvelous relief in a class of patients, by no means small in number, who, suffering from atony (lack of tone) and dilation of the colon (frequently from taking warm enemas without following them by cool enemas as a corrective), are always carrying about with them an enormous accumulation of fecal matter. These patients are variously classified as neurasthenics (nerve exhaustion), hypochondriacs (morbidity and moroseness with exaggerated attention to body conditions), simple dyspepsia, etc., and are treated for biliousness, insomnia, exhaustion and a multitude of ailments, by various needless medicines, when all the conditions are the simple and inevitable result of chronic intestinal intoxication which is promptly relieved by a cleansing bath administered to the colon. The quantity of fecal matter removed in these cases is sometimes enormous. Not infrequently quantities of old putrefying masses, semihardened by long retention, make their appearance after a free coloclyster has been thoroughly administered every day for a week or more, showing that a single irrigation of the colon, no matter how thoroughgoing, is not sufficient. In this class of chronic cases the coloclyster should be administered daily for two or three weeks if needs be, or as long as the patient complains of gaseous distention and flatulence. After the discharge of the warm water first used at a temperature of 92° to 95° (the body temperature is 98.6° F.) one to two pints of water at 60° to 70° should be run in and retained as long as possible as a tonic bath to the colon. Quacks have done much harm in advising the indiscriminate use of warm enemas. Care should be taken to avoid distending the colon with an excessive quantity of water at once. In ordinary cases the coloclyster need never exceed two quarts, and the quantity should be reduced from day to day after the colon has been thoroughly cleaned until only a pint or half pint of cold water is employed. Cold water stimulates and tones the bowel whereas hot water is relaxing. The cold enema

may be used indefinitely without producing constipation if the quantity of water is small. It acts as a sort of gymnastic trainer of the bowel, strengthening its muscular structures and increasing the activity and energy of its controlling nerves and nerve centers.[1]

The cool enema method (not coloclyster) should be progressive. Starting with 80° the final one can be gradually reduced until 70° is reached. *It should as a rule always follow and not precede a natural action.* If on occasion the latter fails, a small, cool irrigation of the rectum only is indicated, with the thighs then closely crossed in order to bring a frequently very effective pressure to bear on the pelvic colon and rectum. This should be accompanied by an erect posture of the trunk as an effective way to aid the muscles involved. With the obstruction removed the usual procedure in the use of the enema as far as the splenic flexure can then be followed. But this should always be considered as a final hygienic measure and not a preliminary one. If compelled to reverse this order, then the patient needs to direct prompt attention to the condition of the bowels by resorting to some of the measures set forth elsewhere both of examination and treatment. Is the tongue coated? Is the urine concentrated and abnormal in both odor and color? Is mucus present in the dark stools? Have the latter lost their homogeneousness (uniform consistency) as to color, density and continuity? Is there a lack of the buoyancy and efficiency characteristic of an efficient functioning of the intestinal tract? These are some of the questions, all based on detailed information set forth elsewhere, that are to be answered before the patient can hope for intelligent control of the deranged bowel function.

Going back now to the second of Case's and Hurst's two general classes of constipation, (omitting the third class caused by a deficiency in the contents of the colon given by Hurst in his 1919 edition, which will receive attention later), constipation in the neighborhood of the cecum remains to be considered.

[1] Kellogg, "Rational Hydrotherapy," 1918.

In all chronic cases the colon should be first emptied where a digital examination is to be made. Then in the next 24 hours the abdomen and rectum should be examined to ascertain whether there is an accumulation in any part of the colon after an attempt to open the bowels without artificial assistance. An accumulation in the cecum and ascending colon or in the transverse colon indicates stasis (delay) in these situations. If more than a very small quantity is found in the rectum and the patient has no desire to defecate, dyschezia can be diagnosed. If the rectum is almost completely empty, the cause must lie in delay in the passage higher up, except in the somewhat rare cases of dyschezia in which there is inability to pass the contents from the pelvic colon into the rectum. In such cases a hard mass can be generally felt through the anterior wall of the rectum.[1] (By resorting to the use of charcoal lozenges as disclosed in Chapter VI the amount of delay can be easily ascertained.)

Most cases are more or less cumulative, the bowels never being completely emptied, so that more and more feces are retained. In dyschezia, for instance, they collect in the rectum or the adjoining pelvic colon and gradually increase from below upwards. It is consequently possible, even where the higher parts of the colon will function normally if permitted, for partial obstruction to occur as the result of the accumulation below. For this reason it is only after the colon has been carefully emptied that the activity of all parts can be properly investigated. Neglect of this precaution has frequently led to the conclusion that stasis or even organic obstruction exists in the descending colon or splenic flexure, or less frequently in the transverse colon, when none is really present. With the bowels thoroughly emptied both by an aperient (mild cathartic) and enemata for two days, on the third and fourth mornings an enema should be given but no aperient and on the last morning a barium breakfast taken. It should

[1] Hurst, "Constipation." If the rectum is impacted a small, cool enema should move the accumulation, says our author in another connection.

be carefully noted that for the last 48 hours the colon is to be free of aperients as the intestinal function may otherwise be observed while still under their influence instead of under normal conditions. During the examination neither aperients or enemata should be taken but attempts made to open the bowels normally under ordinary dietetic and living condition. The examination can often be completed in three days but in cases of severe delay six are sometimes required. Two hours before the examination two ounces of barium for an ordinary sized person may be given with half an ounce of cocoa, half an ounce of sugar and a quarter ounce of cornmeal flour, to which eight ounces of hot water is added. To examine for stricture or other changes in the colon the barium enema is used, composed of 6 ounces of barium sulphate, 1½ pints of water, 1½ ounces acacia mucilage and an ounce of grain alcohol.[1]

Ileal stasis (small intestine) can be diagnosed if no trace of barium has reached the cecum 6 hours after a barium meal. It is, however, very unusual for nothing to enter the cecum within this period even in well-marked cases of ileal stasis, so that the diagnosis has generally to be made on account of the shadow of the ileum (lower 12 ft. of the small intestine) remaining visible for an unusually long period, at least five hours after the last trace of the meal has left the stomach. As it is difficult for the patient to go for more than six hours without food it is practically impossible to diagnose *ileal* stasis in a single day unless the stomach empties itself with normal rapidity, except in the comparatively rare cases already mentioned in which no barium at all has entered the cecum at the end of six hours. If the stomach empties itself in three hours and no additional food is taken for six hours and the barium is still in the end of the ileum nine hours after ingestion, ileal stasis can be diagnosed. But if the stomach is not known to have emptied itself in three hours ileal stasis can only be diagnosed with certainty

[1] Hurst.

if some barium is present in the ileum 24 hours after the meal.[1]

Although the following case from Hurst has a constitutional history it is nevertheless instructive.

A gentleman, aged 50, had been constipated from infancy. Every member of his family, including father, mother and two sisters, suffered from the same cause. For two years he had complained of pain in the left iliac fossa (left flank) which led him to believe that he was suffering from obstruction in that region, though nothing abnormal could be felt. His occupation was indoors. When he had a holiday in the country and took more exercise, specially climbing, he was very much better. Recently he had been able to obtain an action only by continued use of pills and glycerine suppositories.

On examination *after* the bowels had been well emptied nothing abnormal was found and the rectum was contracted and empty. Instead of the cecum being reached by a barium meal in four hours, nothing had passed into the cecum in ten hours. In 24 hours the cecum, ascending colon and most of the transverse colon were visible, but little progress had been made 8 hours later. The barium had not passed the splenic flexure 48 hours after the meal and the left flank was reached only after 73 hours. On abdominal palpation (feeling with the fingers) scybala (hard material) was then distinctly felt in the descending colon, the latter being somewhat tender but quite movable. The rectum was still quite empty and contracted. The flexures (see diagram) were not at all acute in angularity and the intestinal wall was everywhere normal.

The family history of the patient suggested that he was suffering from constitutional constipation due to defective development of the intestinal musculature existing at birth.

The rectum was still empty 75 hours after the bowels had been opened. There was thus no evidence of dyschezia. The contracted condition of the rectum was probably due to the excessive use of glycerine sup-

[1] Hurst.

positories. As the condition present could not be benefited by such stimulus to defecation the patient was advised to discontinue them. The small as well as the large intestine required stimulation, so a stimulating diet and auto-massage with a 7 pound cannon ball rolled over the whole abdomen was recommended. The patient was also instructed to take daily exercise and make more regular efforts to get the bowels to act. He was also given a pill containing nux vomica and a small dose of aloes to take three times a day with instructions to diminish the quantity until perhaps finally it could be discontinued completely.[1]

The method of diagnosis in the above case was excellent, the pill of nux vomica and aloes (the former to tone up the intestine and the latter to stimulate movements of the colon) to be commended, but the exercises with the cannon ball were practically worthless when applied to the colon, as it would in all probability increase the impaction.

In the light of the most advanced and authoritative practice of today, quoted in detail elsewhere, it would seem the above patient needed a proper dietary and free water drinking with change of intestinal flora; the intelligent use of bran and lactose; and carefully selected abdominal exercises; the use of laxative medicaments, changed weekly; and outdoor exercise with habitual practice of deep lung and abdominal breathing and hill climbing.

Although the softening action of oil on feces, says Hurst, is much less effective than water, oil injections are sometimes of undoubted value in detaching scybala (dried feces) from the intestinal walls and lubricating the surface of the contents (not the wet intestinal walls, as is often erroneously asserted), so that the expulsion is facilitated. The oil is only absorbed from the colon to a very slight extent; consequently its injection in the evening retards or prevents the absorption of water from the pelvic colon retained during the night. The colon can be irrigated in the morning.

Spastic constipation, says Kellogg, the result of colitis

[1] Hurst.

and spasmodic contraction of the ileo-cecal valve, due to chronic appendicitis or ovarian disease, and pain in the abdomen, no matter what the cause, should be treated by fomentation (an application of warmth and moisture). The electric fomentation heater is a valuable and ever-ready means of *application of graduated heat to the moist compress.* The best time for applying the fomentation in spastic trouble is soon after breakfast or shortly before the regular time for moving the bowels, or when it is necessary in persons of delicate physique (but without spastic trouble) to increase tolerance of the cool enema. It should be applied for 10 or 15 minutes at as high a temperature as the patient can stand.

Applications can be made two or three times daily, or at least morning and night so as to relax the sharply contracted (spastic) colon. In very pronounced cases of colitis with spasm of the colon, a short, hot tub bath of not more than two to four minutes is of great service. The effect is to lessen the irritability of the nerve centers, and thus relieve the intestinal spasm which may be due to congestion or inflammation of the appendix, ovaries, bladder, rectum, or gall bladder, or still more often to colitis. A most effective variation of this treatment for the relief of intestinal spasms is a bath at 100° F. combined with a spray on the abdomen as hot as it can be borne (115° to 120°) for two to five minutes. It should be followed by a cold spray at a temperature of 80° for one or two minutes, the hands and feet being kept warm.[1]

The hot sitz bath (hip bath in a small tub) at a temperature of 112° to 118° for two or three minutes cannot be too highly praised in the treatment of reflex and spastic constipation, with or without colitis. After the sitz no cold application is made. The best time is upon rising in the morning. In general, prolonged cold baths for as much as even two or three minutes are aggravating to spastic constipation. Also in the use of the enema where there is colitis, abdominal pain or tenderness present the water should be at a temperature of 105° to 115°. Where there is irritation of the mucous

[1] Kellogg.

membrane, particularly in colitis, half an ounce of salt to half a gallon of water tends to lessen the irritation. The application should be repeated until no mucus returns. If the water is not fully evacuated the retained salt may be injurious. In draining it back, where difficulty is experienced, the hips should be elevated with the patient resting on the left side.[1] These directions as to temperature do not apply to the use of the enema in normal cases, which is fully treated elsewhere.

Kellogg is confident he has saved the lives of a number of persons suffering from suppression of urine by the employment of the hot enema at a temperature of 110° to 120° at periods varying from three to four hours. He has used the hot enema for this purpose for more than 20 years. For pain in the bowels such as intestinal, renal (kidney) and hepatic (liver) colic, enteralgia (pain in the bowels) and hyperesthesia (excessive sensibility) of the abdominal ganglia (subsidiary nerve centers) it is highly useful in a large proportion of cases.[1]

[1] Condensed from Kellogg, "Colon Hygiene," and "Rational Hydrotherapy."

Note to Third Edition

The tube of the fountain syringe should never be inserted for more than the depth of the hard rubber end-piece.

Note to Sixth Edition

When an enema has penetrated to the splenic flexure (see page 9) with the patient lying on the left side, massage of the flexure is desirable.

Chapter XXVI

ABDOMINAL EXERCISES A VITAL REQUIREMENT

Weak abdominal muscles are practically always associated with intestinal stasis. The reason is plain, as has been elsewhere several times pointed out. Many people do not realize that they have them, and as to developing a good hard set of them, not one person in a thousand ever gives the matter any attention. In combatting the condition under consideration a number of important remedies have been carefully presented but there is none of more importance than a form of abdominal exercise, regularly maintained for a few minutes each morning, that will enable the patient to largely eliminate the over-valued abdominal massage, that is, as a rule, ineffective yet costly in time, effort and money if performed by a professional and unsatisfactory if done by the patient.

A moment's reflection will disclose why this is so. If the reader desires to greatly strengthen the muscles of the arm, for instance, what will be the most effective way to go about it, by massaging those muscles or by exercising them? The muscles of the abdomen can be punished by pressure and kneading from the surface yet the deep-seated ones, unlike those of the arm, can hardly be reached to any desired extent by such a method. But when the forms of exercise set out in detail below are put into action the patient need do nothing more than spread the palms of the hands over the walls of the abdomen to note the tremendous stirring that is taking place deep under the surface.

Hurst says the majority of cases of constipation at the lower end of the colon in which the voluntary muscles

of defecation are at fault, are caused by weakness of the abdominal muscles. Such weakness is also common among people who take too little exercise, owing to sedentary occupation, laziness or obesity.[1]

Kellogg is of the opinion that the exercises that are of the greatest value in these cases are those which bring the muscles of the abdomen and diaphragm into strong action. The abdominal muscles are generally weak and relaxed and the intra-abdominal pressure consequently low. These muscles may be strengthened, the pressure raised and the colon thus enabled to contract with sufficient impetus.[2]

This is a sound physiological truth and this chapter is written for the purpose of bringing the fact into strong relief. But nothing more is claimed for it than that it is but one of the accessories which, in the aggregate, work out relief when properly utilized *in practically all cases where there is no organic defect.* On the subject of the rapid physical degeneration that follows the giving up by primitive man of his natural habits McCollum makes an interesting observation, that the teeth of the primitive Eskimo are excellent. According to Stefanson, there is no word in their language for toothache. Today those of the younger generation dwelling along the Arctic coast of Alaska have teeth as defective as those of the children in the United States. They have been brought up largely on foods available in grocery stores—flour, sugar, molasses, muscle meat and fish.

Another instance was the quickly developed tuberculosis among the Apache Indians, taken from their wild life to Fort Sill, Oklahoma.

Of course the physical development of the entire body is such a widely recognized support of good health that it would be difficult to say anything new on the subject. But this is not the case with abdominal exercises. Ignorance on this subject is widespread and most disastrous in consequences.

Darwin in discussing the *degenerative* changes that come to organs from disuse says: "The term disuse does

[1] "Constipation."
[2] "Art of Massage."

not relate merely to the lessened actions of muscles but includes a diminished flow of blood to a part or organ from being subjected to fewer alterations of pressure, or from becoming in any way less habitually active." [1]

If a large percentage of overfed house-abiding people do no more than withhold excess of food from weakened stomachs, kidneys and liver and two or three times a day regularly and persistently throw up windows and pick up with much stooping and stretching a big handful of marbles or buttons flung over the floor and under furniture, they will take the first long step to restoring strength and circulation to neglected abdominal muscles. Such people desire health above every other blessing. But like a traveller who has taken the wrong road they need to be told that their skin marked with liver blotches, their pudgy abdomens, rheumatic joints and disorganized liver secretions and many other ills, enumerated elsewhere, have their source in a great majority of cases in ignorance of abdominal hygiene.

The following morning exercises have been found excellent in the development of the abdominal muscles.

1. As a preliminary step massage the colon as directed elsewhere in this chapter, the bladder being first emptied and the three glasses of water not yet taken.

2. Lie on the back, fill the chest with a deep breath and raise the legs to a perpendicular position and lower them. Repeat the movement four or five times with the palms spread over the muscles of the abdomen at first for the reassuring effect on the patient. At first, such is the weakness of the muscles involved, this can be done without fatigue but four or five times. Gradually increase to 10 to 15 times.

3. Lie on the left side and swing the right leg up against a full chest until the knee is well under and almost touching the chin with the foot over the inside of the left thigh, for the benefit of the cecum and ascending colon. This brings a vigorous pressure to bear upon this first section of the colon and liver between the full chest and compressing thigh. Reverse the process by lying on the right side using the left leg for the

[1] "Descent of Man."

descending and pelvic colon. For the first week 10 times a day, gradually to be increased to 20 times or more for each side, divided into two periods of 10 each.

4. To reach the transverse section of the colon and all the abdominal organs cause the intestines to be lifted bodily while the patient lies flat on the back. To do this, first fill the lungs and then exhale to the limit. With the lungs empty raise the chest as though drawing a deep breath but let no breath enter the lungs. This exhaustion of air pressure in the lungs while the movement of deep breathing is vigorously continued will lift the abdominal organs. On the first trial 3 times, repeated 5 times, to be gradually increased to treble the number. This valuable exercise promptly quickens the breath.[1]

5. With a full chest raise the body from the hips up to a perpendicular position and each time press down hard 2 times with the diaphragm against the liver and then twice without such downward pressure, in the latter case touching the toes with the fingers. For the first week 5 of each movement, to be gradually increased to three times this number, 20 of them without the downward pressure. This exercise is designed to develop the efficiency of the liver, transverse colon and the neighboring muscles.

6. Turn over, face down; raise and lower the upper part of the body down to the knees by the hands and arms, inflating the chest to the limit at each second downward movement. This will also cause the breath to come quick, expand the lungs and develop important trunk muscles that usually receive scant attention and use. Five movements at first are enough, to be increased up to 15 or 20 times, stopping always short of fatigue.

7. Lie flat on chest and forearms. Raise the chest and head with the minimum assistance from the arms, to a point where the chin is as high above the bed as possible. At first the limit will generally not exceed 8

[1] The efficiency of this movement was discovered by Kellogg in trying to raise a displaced abdominal organ. He was gratified at the results. The hips should be elevated (See cut page 65).

inches to be increased to 15 inches. This very valuable movement develops muscles of the neck, chest, shoulders, arms, back and abdomen that are much neglected.

8. Practice deep abdominal breathing and exercise by slowly raising the abdominal wall against 10 or 15 pounds of pressure, preferably supplied by a broad, flat sack of sand, or a file of large magazines. Stop short of fatigue and do not persist against pain which may indicate a condition of disease.

9. Lie on the left side and raise the upper part of the trunk sidewise, with as slight help as possible from the arms, until the trunk from the hip up is in a position of moderate curve, but without inflation of the lungs, slowly 5 to 10 times. Then the same movement for the other side. When the right side is lifted the liver is compressed and massaged; on the left side the region of the splenic flexure and descending colon.

10. An excellent finish can be made by taking an upright position on the floor and shooting the hands as high in the air as possible and then bending down until the feet are touched while the lungs are inflated each second movement immediately before the descent. With hands on hips swing the hips in a circular movement, first one way and then to the other. First exercise five times at first with gradual increase to 20; second the same. (Use care in deep breathing. See p. 194.)

By the time No. 7 is finished the pulse should be quickened by some 30 beats to the minute. If there is any organic weakness, especially of the heart, care must be exercised.

If leg exercises are desired, such as raising the body to an upright from a squatting position, and rising on tip toes, etc., they can be added.

People who are feeble or with big stomach girths will have to exercise with care and discretion in all these exercises. The first movement in No. 9 particularly requires moderation.

Of the above exercises 3, 4, 5, 8, 9 (in particular) and 10 are of special value to the liver, while also greatly stimulating other abdominal organs. The largest of these, the liver, is constantly taking up from the blood,

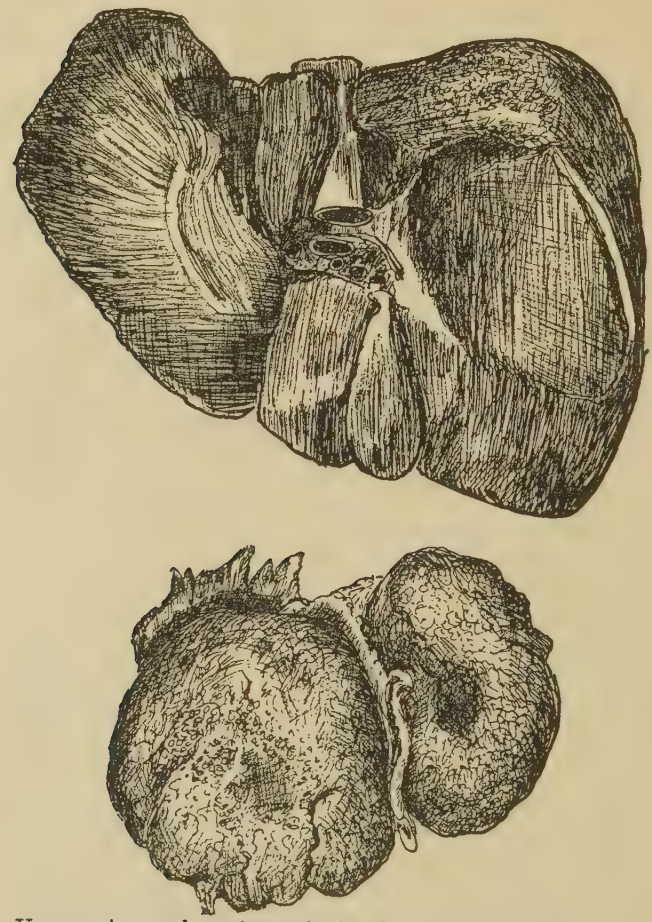
modifying and giving off material of many sorts. These and other functions are easily modified by disturbing influences. Those that are slight are met with compensating actions. But if a disturbance is continued long enough a significant fact emerges—the development of *structural change*.[1] Such a disturbance is supplied by the tippler or a steady drinker. Fothergill says of alcoholic irritation that the liver first enlarges from excess of blood (congestion) and the surface becomes rough (hobnailed liver). The development of granular degeneration (resembling grains or granules) follows in due course. This also is called the drinker's or nutmeg liver because when cut through it looks like a nutmeg. As time goes on the whole organ becomes more or less involved and a shrinking and hardening develops. This condition is called cirrhosis of the liver (a type of sclerosis) and is the ordinary illness from which so many tipplers die years before their time. The rate of progress depends on the amount of alcohol taken and its state of dilution. When taken on an empty stomach the worst result follows.[2]

The liver becomes so debilitated by errors of diet and unhygienic practices that intestinal poisons instead of being destroyed set up inflammation and abscess that may be the starting point of cancer, particularly if cancer cells are present in the intestine; also the flow of bile may become so disorganized that crystals of bile-fat ("stone") form until in an examination after death the gall bladder is sometimes full of gall stones that had not as yet caused enough inconvenience to give rise to a suspicion of their presence.[3] (See the interesting statement by Hurst on this same subject in Chapter XXXII, pages 261-262.)

[1] John Scott Haldane, M.D., Fellow of New College, Oxford (England), in his Silliman lectures at Yale (1916).

[2] Fothergill's "Diseases of Sedentary and Advanced Life." Of course there are other conditions that produce this disease of the liver, such as highly-seasoned food, substances that set up irritation in the intestinal tract, overeating, etc.

[3] Edmund Owen, consulting surgeon of St. Mary's Hospital, London. Author of a standard " Manual of Anatomy for Senior Students"; contributor to the last edition of the Encyclopedia Britannica.



Upper.—An under view of the human liver, showing the gall bladder near lower center. Below, cirrhosis of the liver (hobnailed or drinker's liver).

One of the most important of the liver secretions (stimulated by the abdominal exercises), says Kellogg, the bile, is a stimulant to the colon but not to the small intestine. An excellent proof of this is found in the remarkable colon-stimulating qualities of "bilen," an extract from bile, which when introduced into the rectum often produces active colon movement (peristalsis) within a few minutes. A recent discovery shows that the spleen also produces an active intestinal stimulant, acting upon both the small and large intestine. Another remarkable substance secreted by nature from the pituitary glands of the brain and secured externally from cattle, is a most powerful stimulant of the entire intestinal tract. Recent observations have shown that putrefactive bacteria are carried from the colon in great numbers through the walls of the intestine into the blood stream that goes directly to the liver (portal circulation) where many of them are destroyed, but not a few may pass out in the bile and infect the bile passages. In some cases it is possible that infection may occur directly from the intestine. The bacteria may also ascend the gall duct to the gall bladder and liver. Modern research shows that gall stones are practically always due to bacteria, found in the interior of these concretions, and which are almost invariably associated with constipation. Marked enlargement of the liver and spleen are frequently the result of chronic constipation. The infecting germs may pass direct to the right kidney, through the closely adjacent wall of the colon.[1]

Resuming the question of exercise, Fothergill says the matter is of far more moment than before Voit made the discovery that we can store up oxygen for use when we are placed where the supply of oxygen is deficient. A man devotes time to his meals; he ought also to devote it to storing up oxygen; and so he will when he knows that such storage is feasible. As it is he is utterly ignorant of the fact and only takes exercise because he believes it is "good for him." If he

[1] "Colon Hygiene." Hurst also says elsewhere the right kidney is most frequently affected.

really understands the subject he will sedulously cultivate the air in every way, especially in the practice of deep breathing, and at every opportunity. Many a case of tuberculosis associated with indoor occupation would by this simple method be avoided.[1]

The following fine statement of the *value of general exercise* is by an able physician at the age of 94.

When reasoning about the remarkable improvement in the heart's action and in the mental and physical conditions effected by climbing tours, Sir Hermann Weber came to the conclusion that it was caused in a great degree by the deep breathing which is induced by the act of climbing, especially steady and prolonged climbing. This led him to pay particular attention to breathing exercises which later were useful to himself and many of his patients, especially persons of sedentary occupations. By deep breathing the entire lungs, including the apices and bases, become expanded, while in ordinary breathing the apices (plural of apex—in this case the air chambers farthest from the base) are only partially inflated. The flow of blood and lymph through them is imperfect. In consequence of being ill-nourished they become the seat of disease such as chronic catarrh and tuberculosis. As in walking and other bodily exercises moderation must be exercised in deep breathing, as it is often injurious in cases of great weakness of the heart or lungs or in the after effects of pneumonia or other acute diseases, especially rheumatic fever and influenza. Even in healthy persons a commencement should be made with moderately deep breathing in a well-ventilated apartment and continued during two to five minutes with gradual increases to ten minutes or a quarter of an hour or longer once or twice a day. The duration of the breath should likewise be gradually increased. At the beginning ten seconds or less for each inspiration (intake of breath) and each expiration ought to be sufficient. If this is well borne each act may be gradually prolonged to a quarter of a minute or more.

[1] "Diseases of Sedentary and Advanced Life." This is the truth behind the sleeping porch development—storing up oxygen at night to make good losses during the day.

The right position is to stand erect with raised arms and closed mouth during the intake of breath; then to bend the body down, retaining the breath if it can be done without distress, so that the fingers touch the ground or the toes. The intake must be through the nose, by which means the air is moistened, warmed and strained. The expiration can be through the mouth. An important point during the expiration is to thoroughly contract the abdominal muscles to strengthen them, and compress the intestines.* By degrees the abdominal movements can be developed into stretching, side bending and circular bending during each inspiration with several up and down movements. These exercises also bring into exercise muscles of the back which are apt to be imperfectly developed by most people. Thus we keep the spine flexible and correct the tendency to stoop, so common in old people, and the bad posture of many that are young. There are other combinations such as swinging the legs over a chair, or rising on a step as if starting upstairs, first with one foot and leg and then with the other, with alternate inspirations and expirations. In addition to these, other muscle and joint movements in connection with deep breathing of good air will occur to the exerciser. But the main attention must not be diverted from the breathing exercises since to them the beneficial effect on the heart, blood vessels and lungs is mainly due. In addition they promote nutrition, elasticity and efficiency of the lungs which are apt to undergo a kind of atrophy (shrinking) in old age. The permanent distention of air cells of the lungs in old people and likewise the destruction of many of the small blood vessels of the lungs, diminishing the aërating surface of the blood, is thus prevented; also such results as heart dilatation, heart failure, and all its attendant troubles of which the chief symptoms are shortness of breath and attacks of bronchitis, with certain breathing irregularities, seen also in asthma. By improving the nutrition of the lungs we also counteract the

* Or one entire movement (up and down) can be completed *with chest expanded* in order to increase the abdominal pressure, if without discomfort.

tendency to chronic bronchial catarrh and pneumonia, which are the most frequent causes of death in old age. Deep breathing also assists in removing slight, passive, watery effusions in the lung cavity by acting as a respiratory pump. The elasticity of the chest walls is also maintained. They are apt to become rigid with advancing age. Intimately connected with this elasticity is the healthy condition of the rib bones and their marrow, which greatly favors the formation of the blood globules; also by the contraction of the diaphragm, the liver, the spleen and other abdominal organs are thoroughly massaged, the blood squeezed out towards the heart and the latter forced to contract more vigorously. Thus abdominal venosity (vein congestion) is avoided. The most convenient time for practicing these exercises is in the morning before and after the bath, either naked or clothed lightly, and in the evening when dressing for dinner. Persons deprived of the power of walking should frequently and regularly practice deep abdominal breathing exercises by downward pressure of the diaphragm while driving, or sitting out of doors or near an open window. Very great benefit should result if this regimen is faithfully adhered to. *The habit of deep breathing must be created and then maintained.* To it should be added very valuable static or tension exercises while sitting or lying quietly in bed, by the contraction of all the muscles of the body for one or two minutes, several times a day.

In action from exercise the smallest arteries of the muscles become widened, more blood flows into the capillaries (the smallest blood vessels) and the flow of lymph is increased, thus more nourishment and more oxygen are carried to the tissues and at the same time the products of waste are removed. It is, however, not only the muscular fiber which gains, but the nutritive vessels and absorbents gain as much by being kept in action. The increased afflux of blood forces the small vessels to work in conducting more blood to the tissues, and thus their coats are maintained in a sound condition. At the same time the lymphatics are kept in action by the removal of increased amounts of fluid from the lymph spaces, con-

taining the used-up material and the substances not wanted by the muscular fibers. Similar is the case with the brain and nerve centers. The increased afflux of blood to the brain by the act of thinking has by the ingenious experiment of Mosso of Rome, been demonstrated. The subject was placed horizontally on a finely balanced table and in the act of thinking the head end of the table went down. Through a hole in the skull of a person he also observed that the volume of the brain increased in size. Muscular exercise also acts as a powerful means of preventing arterio-sclerosis, which Sir Lauder Brunton calls "the great enemy to longevity."

The atrophy (shrinking) of the muscles is in most persons, one of the first signs of the weakness of old age and is one of the main causes of the loss of weight and of the deterioration of the power of heat production in old people. The beneficial influence of walking extends to all the organs of the body, internal as well as external. Many persons think that walking exercise is quite unnecessary; but the great majority of those who hold that view and act on it suffer in later years from the neglect. Many persons also walk very little in the winter, especially those engaged in offices. This is one of the principal causes why, during the winter and early spring, the resisting power of many people is diminished, and why in consequence they fall a prey to frequent colds, bronchitis, pneumonia, rheumatic fever and other illnesses of spring. Those who spend several hours by night or day in the open, with their lungs well expanded and filled with fresh air, are infinitely less liable to such diseases than those who remain indoors. Some persons walk with a firm step, well-contracted muscles and the body held erect. Others walk with a slack step, half-bent knees and a partial stoop. There is a great tendency to this latter in old age which ought to be fought against with strength of will. When a person accustomed to a distance of one or two miles an hour is induced by vigorous companions to walk four or more, great harm is occasionally done. Stout persons, many of whom have weak hearts, ought not to run or walk fast. Whatever can be accomplished by the aged in both the matter of pace and amount of exercise

ought to be maintained, but exhaustion ought to be avoided. The condition of the vital organs, especially the blood vessels, is of greater importance than the number of years. Persons advancing in years, after having been prevented by illness or other causes from taking their regular walks, feel fatigued when again resuming them and infer that they are too old or too weak to take such exercise. When such persons begin with short walks to be gradually increased, they quickly regain the habit of regular exercise and thus postpone the penalities of old age. The same holds good with the giving up of the exercise of the mind and of professional or other work. To many persons the retiring from business or from work on obtaining a fortune or a pension is the cause of premature decay. A remarkable instance of this result was observed in the case of a legless beggar who in following his livelihood wheeled himself about the public promenades. At 50 he retired with a modest competence and thereafter remained in his room or on his doorstep, sleeping much and eating heartily. In four years he was dead of apoplexy. Many more people wear out from overrest, generally associated with overeating, than from overexercise.[1]

The Case for Massage

One of the best authorities says massage has no rival in promoting intestinal activity. It promotes the more rapid emptying of the stomach, excites the intestinal reflexes (nerve stimulation) whereby the alimentary mass is moved more rapidly through the small intestine and colon to its final discharge from the body and greatly increases the number of corpuscles of the blood, to as much as 7 per cent in the red cells and from 50 to 80 per cent in the white cells. This increase usually, in the cases under observation, becomes apparent within 30 minutes and lasts from an hour and a half to two hours. In persons in whom the blood count (of corpuscles) is deficient the increase continues for several hours, and if the application

[1] Sir Hermann Weber, "Longevity." See page 240.

is repeated daily there will be a permanent increase in blood from day to day.[1]

We are interested here particularly only in that form of massage that is supposed to promote vigor and activity of the intestinal tract. A great deal has been written in an advisory way on this subject with rather unsatisfactory results. Case (for footnote, see index) goes so far as to say that even with strong pressure it is not possible by massage to lift the contents of the ascending colon into the transverse colon nor to advance the contents of the transverse colon into the lower portion of the bowel. In only a few cases of his many observations with the x-rays was it possible to effect any movements of the bowel contents even for short distances. Groedel, says Case, was unable to accomplish this with a vibrator in full action. Case was able to move a small bolus of food along several inches of a gas-distended colon, but in general it holds true that the contents of the colon can be shifted very little by massage. The reason for this difficulty is that the colon attaches itself very closely to its contents by means of the haustral contractions so that these haustra (tucks making up the outside fluted form of the colon) are so many grips or brakes upon the bowel contents.[2] So we must conclude that the well-recognized favorable influence of massage and mechanical vibration must be produced indirectly through increasing the tone of the bowel muscle rather than through any actual mechanical pressure on the bowel.

As a contributory means for the relief of intestinal stasis massage has received a great deal of attention with results that are in doubt, although Hurst says he has on several occasions seen considerable benefit result from massage applied to the part of the colon in which the x-rays had located stasis. When this is independent of spasm the massage should be deep and moderately vigorous, but where there is spasm it should be superficial and gentle.

The most effective means of colon massage is to begin

[1] Kellogg's "Art of Massage." These same results are accomplished in the largest measure by the abdominal exercises as set out elsewhere.

[2] *Journal Iowa State Medical Society*, 1916.

with the last 12 inches of the small intestine, thence to the ileo-cecal valve, thence up the ascending colon to the hepatic flexure, across and along the transverse colon to the splenic flexure, thence down the descending colon to the pelvic colon and as far as possible within the pelvis, as recommended by Kellogg. To do this with a deep indentation by the finger tips in a semi-spiral motion it is plain that knowledge of the location of the transverse colon must be obtained, as it frequently drops in a loop to a position below the navel owing to its relaxed condition, and the weight of the delayed contents generally present. A person of finger sensibility and intelligence can often secure this information by the delicate sensitiveness of the finger tips. The impacted contents are easily distinguished from the surrounding soft tissue. Also it is often found that the course of the colon is marked by tenderness that deepens into pain upon pressure. After irrigation in the knee chest position and the colon is thoroughly emptied the pain in the region of the colon on pressure, if from functional causes, is quickly relieved. But the most effective method of accurately locating the colon is by means of the barium meal, or barium enema, fully described elsewhere.

With the above information in hand as completely as possible a deep rotary motion with the finger tips should begin on the last 12 inch section of the ileum (lower end of the small intestine), while lying on the back in bed, follow its general line to the cecum, first on its upper side and then on the lower, with deep, curving indentations, corresponding roughly with the curves of the colon (haustra). With each impression of the fingers, increase the pressure by raising the abdomen stiffly against the fingers, thus developing a squeeze of the ileum and colon between the fingers and internal pressure.

From the cecum to the hepatic flexure, while lying on the right side.

Across the transverse colon, and down to the sigmoid flexure with relaxed abdomen while lying on the left side.

The semi-rotary motion of the finger tips, with deep pressure, should describe elongated shallow loops. If there is an error in the location of the colon the loops will be large enough to probably cross its course.

Chapter XXVII

THE COATED TONGUE—ITS CAUSE AND MEANING

The coated tongue is due to the blood being charged with toxins. The tongue's resistance and that of other fluids is thus lowered, the saliva loses its power to stop the growth of micro-organisms and the mouth becomes an incubating chamber in which molds and bacteria of various sorts grow luxuriantly. In this condition the colon should be cleansed up to the cecum by coloclyster (high enema) once or twice daily. Five minutes should be consumed in allowing the colon to fill in the knee-chest position (the chest lower than the hips) and the last enema should be at 80°.[1]

Boas says uncleanliness of the tongue is often the cause of bitter taste and bad odor. By scraping off the "fur" (bacteria, mucus, molds, deposits from the stomach or intestine and horny growth on the tongue) with a cotton swab or spatula one may frequently convince one's self of the source of the bad odor.[2]

Wainwright thinks the tongue may be a good index of intestinal health, and a foul condition of the breath speaks volumes of what may be suspected lower down, although in the ordinary sense the patient may not be constipated.[3] In such cases, says Kellogg, the constipation is latent. A barium meal will show ileum stasis of a most pronounced degree (delay in the ileum, small intestine), most often in the last twelve inches. When the tongue is thickly coated the breath has a bad odor and not infrequently a characteristic fecal odor. In such

[1] Kellogg, "Autointoxication."
[2] Dr. I. Boas, specialist in gastro-enteric diseases, Berlin.
[3] Lennox Wainwright, President of the Folkestone Division of the British Medical Society.

cases there will always be found very pronounced intestinal stasis, the food residues and other body wastes being retained in the colon to putrefy instead of being promptly dismissed.[1]

Such *chronic* conditions indicate, along with constipation, a defective ileo-cecal valve and an inefficient intestinal flora (microscopic plant life). With the stasis and flora corrected the defective valve will not need attention. Even if such a valve were mended by a surgical operation and the condition that caused it allowed to remain, the former defect in the valve would recur.[2]

Dickenson [3] remarks on the small amount of good medical literature in existence on this subject; that while every physician from the time of Hippocrates has habitually looked at the tongue of patients, it was done apart from any consideration of theory as to cause and effect. His own theory is that the tongue is an index of constitutional states, seldom of individual diseases. It seldom points to solitary organs or isolated disorders, but is rather a gauge of the effects of disease upon the system than an indication of the locality of it. It is often a guide in treatment so far as treatment is general not local; and it is an important help in prognosis (conclusion as to the course of the disease). From the standpoint of the doctor it always speaks the truth and a language that is not foreign to the experienced physician. And how much truth is to be read on so small a page! Conditions of fever and of feeding; states of the nervous system; the maintenance or abeyance of vital secretions; failure of vitality although we may not be able to find out why; in one case that the patient is improving, in another that he is wasting—all these are discernible to the naked eye.

The two health factors which stand before all others as indicated by the tongue, are the heat of the body and the secretion of saliva. There is a remarkable corre-

[1] "New Dietetics."
[2] Kellogg, personal communication.
[3] W. Howship Dickenson, Honorary Fellow of Caius College, Cambridge, England; Senior Physician and Lecturer on Medicine, St. George's Hospital, in a series of four lectures *On the Tongue as an Indication of Disease*, before the Royal College of Physicians, London, March, 1888.

spondence between the heat of the body and the coating on the tongue. If the tongue is coated the indication is usually of fever without necessarily special reference to the stomach or liver, and points more to the general system than to the alimentary. The dryness, furring and incrustation are connected with the dearth of saliva, which is an indication always of importance. It is difficult not to infer that with the failure of the salivary glands to function there are other glandular failures, more especially of the digestive system. The speaker had often taken the dry tongue as an indication for peptonized food (predigested). On this subject, however, he had not reached a final conclusion. When the tongue becomes dry and bare, from lack of saliva, it is ill with the patient. He is not sure to die but likely to. The completely bare, red, raw and dry tongue is comparatively rare. The term denuded relates to the completeness of the loss of epithelium (the surface tissue) in certain places, not to its spread over the whole tongue. The indication of the red, smooth tongue is for tonics, stimulants and food, probably liquid but nourishing. The failing pulse does not more surely tell of weakness than, as a rule, does the dry, red and polished tongue. A glance may suffice to show whether it is on the road towards health or from it. When the tongue is approaching the condition of health, so, as a rule, is the patient, as is seen whenever the red, dry and bare tongue acquires moisture and clothing. In fevers the gradual recovery by the tongue of moisture and the exposure of a normal surface at the tip and edges, as the coat recedes, are favorable indications of the greatest significance. There is no better sign in diabetes than the resumption of the natural moisture by a tongue which has been dry. Something may be judged by the way an encrusted tongue cleans; if gradually and from the edges, well; less so when it scales, especially when the surface exposed is red and dry.[1]

One glance at a coated or plastered tongue may give an assurance which perhaps could not be otherwise obtained, that the disease is on the wane. If the thick coat in the

[1] Dickenson.

center steeply shelves towards the sides and front, revealing a normal moist, not over-injected surface, the tongue is in process of cleaning; the natural friction is overcoming the coating process, and tongue and patient are on the mend. A tongue acquires a coat more evenly and generally than it parts with it. We can thus tell whether the coating is on the advance or decline and apply this rule to the disease.[1] The dry tongue as an evil omen has long been recognized. Hippocrates[2] more than once refers to it. The speaker's cases, without any special selection, show with the dry tongue, be its origin what it may, a startling mortality, one of almost exactly 50 per cent—56 out of 113. Excess of urine in diabetes mellitus (secondary diabetes) is a cause of extreme dryness of the tongue. Out of 113 cases there were eight of this disease.[1]

The last stage which may succeed the furred tongue or ensue independently, is where the papilla[3] are concealed by an incrustation, usually dark and dry by which the surface is overlaid. From this, the climax of addition, the scale descends through the process of subtraction. With some persons a coated tongue is habitual and not only consistent with health but a sign of it. On the other hand diseases like pneumonia, in which commonly the tongue is quickly and thickly coated, may fail to produce this result. There are peculiarities of the health which concern the saliva. An old woman displayed under capillary bronchitis (inflammation of the smaller tubes) a red, dry tongue (not coated), from which I was disposed to augur ill. She got well and the tongue remained the same. She assured me she had always been so, and I could only infer a want of saliva.[1]

Microscopic examination of the coated tongue shows the papilla (of the surface) are prominent. There is scarcely an acute or sub-acute disorder at some period of which the tongue is not coated. Want of wear must have some effect in producing this elongation of these papilla. Not only are the tips, to which the wear only

[1] Dickenson.
[2] 460-375 years B.C.
[3] The small projections on the surface of the tongue.

applies, elongated, but so in many cases are the deeper parts of the column which are unexposed. Coating therefore is the result in part of disuse, want of rubbing and washing but chiefly of morbid overgrowth. Cases requiring a restriction to a liquid diet are seen daily. The physician is guided chiefly by the presence of fever and the state of the tongue; the more coated the tongue the more liquid the diet. If the tongue be dry the diet is wholly liquid and alcohol a part of it. As the acute disease abates the tongue cleans. Solids are then added and may help the process, but the cleaning comes first. The influence of food and mastication can be considered as no more than of secondary importance.[1]

As to constipation some forms of it or disease associated with it are undoubtedly connected with changes in the tongue. It is not difficult to cite cases where the tongue has remained natural under long constipation either functional or connected with chronic obstruction. On the other hand where the obstruction is acute, the tongue early becomes stippled or coated and dry. The determining factor seems to be the presence or absence of constitutional disturbance which is often not present with simple constipation, or chronic obstruction where the tongue is natural.[1]

Kast [2] gave lycopodium powder, per rectum, in sealed capsules to a number of persons and was able to recover the typical spores of the powder in the mouths of most of them the next morning.

Alvarez [3] has confirmed these experiments. He cites the fact that Grutzner, Sweieznski, Reach and Hemmeter, all German experimenters, have shown in animals and in man that lycopodium spores, or other finely divided and easily recognizable material, given in enemas, will travel in a few hours from the rectum to the stomach. Uffenheimer and Dieterlen, also German investigators, have found

[1] Same.
[2] L. Kast. *Berl. klin. Wochnschr.* (1906).
[3] Walter C. Alvarez, M.D. "The Mechanics of the Digestive Tract" (Paul B. Hoeber, N. Y.). 1922, assistant professor of Research Medicine, University of California Medical School and on the staff of the Geo. Williams Hooper Foundation for Medical Research.

that bacillus prodigiosus injected into the rectum could be recovered from the pharynx (in the throat) a few hours afterwards. Alvarez has observed that long before fecal vomiting a brown coating appeared on the patient's tongue with a typical fecal odor. Hence, he thinks it probable that many coated tongues are due to the regurgitation of gastric and intestinal contents, especially during the night. This view, he thinks, is strengthened by the fact that the coating is often heaviest at those times when belching, regurgitation and the feeling of biliousness are most pronounced. He also thinks it probable that the odor of bad breaths comes from actual intestinal material deposited on the back of the tongue, although he does not attribute all coated tongues to such reverse currents. There are other factors, such as the nose, mouth, teeth, pharynx and salivary glands, which must be studied in individual cases. Alvarez gives an instructive instance of a constipated infant who regurgitated so much that her pillow was always wet. After a few weeks her bowels suddenly became a little loose, and the day on which this occurred the mother was surprised to find the pillow perfectly dry. It remained that way for over a week until the bowels became again obstructed. Apparently the establishment of a good current downward instantly stopped all regurgitation upward.

The presence of much bile in vomitus is frequently mistaken by physicians as the cause of the emesis (vomiting). Our author rejects this theory and quotes six German experimenters who by surgical operations on lower animals caused all the secretions of the liver and pancreas to pass through the stomach and there was no vomiting. Hence Alvarez was of the opinion that the presence of bile-stained fluids in the stomach which had been emptied a few minutes before can be taken as regurgitation from the bowel, and that the back flow and the vomiting have the same cause.

He also rejects the view that heartburn indicates a state of acidity of the stomach, quoting E. Schutz, a German authority, J. D. Steele and G. G. Stockton, American authorities, in support of his opinion. The true theory, he thinks, is that expressed by Reichmann, a German au-

thority, who had people swallow a little gelatin-coated sponge on the end of a string. After leaving it for ten minutes in the lower esophagus (just above the stomach) it was pulled out and relieved of its contents by squeezing, when it was found that the liquid was acid in persons who had heartburn and alkaline in normal controls. He concluded therefore that heartburn was due to the regurgitation (expulsion upwards) of the gastric juice (of the stomach).

As to the cause of the acidity in heartburn Fothergill says that it is generally caused by the decomposition of some fat in the stomach, of which there is an excess in the food, with the formation of a fatty acid like butyric acid. In the escape of gas from the stomach, the esophagus being very sensitive, the acrid fatty acid sets up a condition known as heartburn or cardialgia. Of old a favorite cure was sour buttermilk. Such an acid as lactic (buttermilk) or of citric (lemon and orange), which kills the feebler irritant fatty acid, is better for heartburn than an alkali like soda, which forms with butyric acid a butyrate of soda, scarcely less irritant than free acid.[1] (An additional fact is that where there is a deficiency of hydrochloric acid in the gastric juice, which is frequently the case, soda is contraindicated, as neutralizing the little acid there is.)

How regurgitation can be caused is made plain by Bernheim[2] who says that during a treatment of a woman for floating kidney, nervousness and general debility he administered enemas of cottonseed oil. About five hours after the injection the patient vomited cotton seed oil. These enemas were administered for over two weeks and this was the only time when there was a backflow of oil to the stomach. Bernheim afterwards experimented with another human subject and found that four minute particles of tin foil used in an enema were recovered from the stomach by the instrumentality of a stomach tube. Altogether he made 7 experiments on a man, 7 on a dog and 6 on a woman patient, a total of 20. Of these, 3

[1] "Diseases of Sedentary and Advanced Life."
[2] Albert Bernheim, M.D., of Philadelphia, in the *Journal of the American Medical Association*, Feb. 16, 1901.

made with oil and 10 made with a table salt solution proved successful; 4 with the latter solution proved negative as far as the stomach was concerned, while 3 made with distilled water were also negative, (13 successful 7 negative).

Biliousness, according to Alvarez, derives its name probably from the fact that patients note bile in the regurgitated or vomited material. As presence of bile in the stomach is normal, any excess need not indicate liver trouble so much as an increase in the normal backflow from the duodenum (upper end of the small intestine). The relief these people derive from purgation, particularly by calomel, is due not to any action on the liver (for all pharmacologists are agreed there is no such action) but probably to a restoration of the downward current. The relief comes so promptly that Alvarez is sure it cannot be due to the removal of a source of toxins.

In the matter of reverse peristalsis (reversal of the ordinary downward movement of the intestine) Alvarez cites a homely incident that has such universal application that we summarized it. Two boys ate heartily of blackberries at dinner. The next morning A had diarrhea but B seemed all right. Early in the afternoon B began to complain of dizziness, a queer feeling of pressure in pharynx (a part of the swallowing apparatus) and recurrent waves of nausea, which came every 20 or 30 minutes). Once or twice he retched unsuccessfully. At supper he made several attempts to eat but each time said the food would not go down. He then felt like defecating and with the help of an enema passed a hard plug. Following this he had a large soft movement containing the remains of the blackberries, and immediately after he asked for food. This child appeared to have had a series of reverse waves which arose in a colon distended by irritant material. These waves took the form of surges of nausea and dizziness with a tension in the throat and an inability to take more food. If the lower bowel had not been emptied when it was B would probably have vomited large amounts of intestinal fluid the next day and a few days later the material might have become fecal in character.

Alvarez says he has talked with a number of intelligent persons who objected to nourishment by means of nutrient enemas because they did not like its bitter taste afterwards. He credits Dr. Emge, of San Francisco, with the statement that after severe pelvic operations (in the lower abdomen) it is his practice to give enemas of coffee which can later be detected in vomited material. At first he thought it was dark blood but chemical examination disclosed that it was coffee.

Chapter XXVIII

IS SUGAR OF MILK THE LONG SOUGHT REMEDY?

What bids to be a true and long sought corrective for both uncomplicated, acute and chronic constipation is a result of very recent studies on the reactions of lactose (sugar of milk) and dextrine to conditions in the intestinal tract. The subject is important enough to require a historical review.

After much wandering in the wilderness the feet of investigators struck what seemed to be the right path in 1886, when Escherich, a German investigator, found that the intestinal tract of a newly-born infant is sterile (with a total absence of micro-organisms), and remains so until the digestive products of the first mother's milk enter it. This work was effectively carried forward by Tissier (a French investigator) and Moro (German) in 1900-1905. Tissier found that two bacilli, bif'idus and ac-id-oph'-il-us, then became predominant among the micro-organisms present. (Note these two bacilli carefully as they are frequently referred to.)

The first of these is a strict anaërobe (living without air) isolated by Tissier not only from the stools of nursing infants but from the superficial milk ducts of the mammary glands of mothers. It is in shape a slender rod, that in cultures develops split ends (bifid). Its most important characteristic as a vegetable micro-organism is that it produces acids freely but no gas from a carbohydrate, lactose (which is sugar of milk), and other sugars.

The second one with a long name, acidophilus, is a Gram-positive (that can be stained), non-spore-bearing bacillus, characterized by its tolerance of acid, frequently

forming chains in cultures and *producing acids freely* from carbohydrates (represented by sugars, starches and cellulose). A very important fact is that this benign organism is *primarily of intestinal origin and not milk borne* and the only reason it is so frequently absent in the intestine of man is the same that causes vegetables in the ill-kept kitchen garden to lose out in a contest with weeds.[1]

It was also found that this simple flora (plant life) is not characteristic of bottle-fed infants. Instead of the bifidus being predominant, there is a more varied and less constant flora as a result of bottled milk.

This new and inviting field attracted numerous competent observers, but it was not until another decade had passed that numerous individualistic observations and theories began to evolve important generalizations.

Hull and Rettger[2] (1914) observed that mixed grain feed tends to transform the flora of the rat, but that no profound change takes place until milk or lactose (milk sugar) is added to the diet. The preponderance of the bacillus acidophilus over other organisms was brought about within three days after a diet of vegetables and bread was followed by one of mixed grain and milk. When lactose was fed in appreciable amounts the transformation period was very short and the change in type of bacteria was practically 100 per cent. It was noted, however, that the b. acidophilus phase was often more or less temporary, this organism giving away to b. bifidus. By 1917 Hull and Rettger found that 2 or 3 grams of lactose are sufficient to establish characteristic flora in the white rat (that is bifidus and acidophilus) within three days. It required a longer time to transform the flora by milk-feeding than by the use of lactose and the change was not nearly so complete. Meat, or a high protein diet, caused an increase of the relative numbers of putrefactive bacteria, which could be again reduced by the addition of lactose to the diet.[3]

[1] "Pathogenic Micro-organisms," Park and Williams (Lea and Febiger).

[2] Of the Sheffield Laboratory of Bacteriology and Hygiene, Yale University.

[3] *Journal Bacteriology*, V. 2.

Further interesting conclusions of these competent observers were that lactose fed either dry or in solution promptly reduced the bacteria of the white rat to the aciduric (acid-forming) type; that this condition remained as long as the lactose was fed; that the dry sugar reached the colon effectively while in the fluid condition it could not be demonstrated below the ileo-cecal valve (beginning of the colon); that a rich meat diet could be neutralized in the matter of putrefaction by lactose, the daily amount of sugar varying in individual rats from 2 to 3 grams. Weiss, of Germany, had demonstrated as early as 1904 that a diet of milk resulted in colonizing the intestines with large percentages of acidophilus. He also noted that malt soup effected the same result, while sucrose (a general name for sugars identical with cane sugar) did not. When milk was reinforced with lactose (the sugar element in milk) he found that bacillus bifidus became predominant as it did when mother's milk was fed, and attributed the result in both cases to the presence of the lactose.

An additional fact of great value was demonstrated by the Rettger experiments, that the well-advertised sour milk bacillus bulgaricus, of Metchnikoff, could not be successfully implanted in the intestines of man. It was impossible to recover bulgaricus from the feces of rats that had been fed as much as 2 cubic centimeters of living bulgaricus suspension (solution) together with 2 grams of lactose. But the acidophilus was easily distinguishable when lactose was alone added to the food. And curiously when milk was soured by the use of bulgaricus, isolated from preparations of five different strains put on the market by as many different laboratories, the bacillus recovered from the feces was not bulgaricus but acidophilus.* This was a confirmation of previous experiments that, however, had not been conclusive.

Torrey in 1919 found that 50 grams of lactose or dextrine when added to a meat and rice diet for dogs caused

* Thus the public in the case of bulgaricus was induced to buy a much-advertised article in the form of tablets before its efficiency had been demonstrated in responsible quarters, just as it has been buying many other commercialized so-called vitamin preparations, toothpastes, etc.

the ordinary mixed flora to be changed to a simpler one dominated by acidophilus. Also that bread and milk produced a growth of micro-organisms consisting almost entirely of acidophilus. Saccharose (the ordinary pure sugar of commerce), maltose (produced from starch paste by the action of malt or diastase) and glucose (a group of sugars less sweet than ordinary sugar, the two best known being malt sugar and fruit sugar) exercised a doubtful influence,[1] if any.

Two years before the publication of Torrey's observations Rettger had reached similar results with different instrumentalities.

In the table below rats to the number of 66 were employed and between 1200 and 1300 fecal specimens subjected to laboratory tests. In every experiment the animals were first given a basic diet which was found to develop the usual mixed and complex intestinal flora,

Diet in Grams.		Feeding Period.	Experiment Number.	Acidophilus in Excreta.
Bread	10	15 days	55.....	4%
Beef	3		56.....	1%
Bread	10		57.....	98%
Beef	3	"		
Lactose	2		58.....	96%
Bread	10		59.....	2%
Beef	3	"		
Maltose	2		60.....	3%
Bread	10		61.....	97%
Beef	3	"		
Dextrine	2		62.....	99%
Bread	10		63.....	2%
Beef	3	"		
Sucrose	2		64.....	6%
Bread	10		65.....	5%
Beef	3	"		
Dextrose	2		66.....	4%

without completely eliminating acidophilus, a normal inhabitant of the alimentary tract of both man and the

[1] J. C. Torrey, in the *Journal of Medical Research*, 1919.

lower animals. This bread and meat diet encourages "putrefactive" and gas-producing types of intestinal bacteria. The fecal material from the cecum and colon of the rats fed on either lactose or dextrine revealed a completely transformed flora dominated almost entirely by acidophilus. It was found that neither lactose nor dextrine is completely absorbed from the intestine of white rats when 2 grams are fed daily.

This bacillus acidophilus, discovered by Moro, of Germany, in 1900, is now found to be a common inhabitant of the alimentary tract of the white rat. It is equally a natural, benign and desirable inhabitant of the alimentary tract of man. Given the normal media to thrive in it not only creates the intestinal conditions of good health but seems to be the long-sought-for remedy for constipation. The reports from many quarters on behalf of intelligent lay observers are of enthusiastic approval. A score or more of bacteriologists, principally in Germany and America, conducting patiently their investigations over more than a score of years, have reached practically the same results. That these results are not absolutely uniform (there is one exception), is because no two observers were dealing with exactly the same factors. The exception was that Torrey was the only one that investigated the influence of lactose in the food of typhoid fever patients. Nevertheless the fact that he easily succeeded in introducing the bacillus acidophilus in relatively large numbers into the feces of patients has a strong confirmatory effect on the experiments of Rettger with several thousand chicks and over 1200 rats, where the same results were produced.

The present authors requested an intelligent layman who had been bedeviled with constipation for 30 years to furnish the readers of this book a report on his use of lactose upon prescription. He replied as follows:

> "My case was diagnosed as that form of intestinal stasis commonly known as constipation, that is associated with excessive acidity of the digestive juice of the stomach. I was instructed to avoid acid foods and use olive oil and butter as

neutralizing agents freely. This excess of hydrochloric acid in the gastric juice seems to increase its activity as a digestive agent. At least the colon contents were too small in bulk and apparently overdigested. I came to thoroughly believe that this excess of acid and overdigestion was the cause of my condition. To increase the bulk of the intestinal refuse I depended almost wholly on bran and to relieve the dryness I depended on water drinking, to the extent of about 8 glasses (64 ounces) a day, or more. For quite a while the bran was not effective but this I found was because the quantity was too small. When it was increased to nearly a glassful a day, partly by admixture with cereal and partly by being stirred into two glasses of water within an hour after each meal, the results were very satisfactory. The residue, instead of being small, dark and compact, was loose and lighter in color, with a strong tendency to disintegrate. In support of the bran I commenced upon direction and practiced daily abdominal exercises and deep abdominal breathing. The exercises are taken early in the morning or any time during the latter part of the night in bed when I happen to be awake after first emptying the bladder. They never consume over fifteen minutes but increase the abdominal circulation to such an extent that the brain is left with a lessened blood supply. That induces ready sleep. Either late in the night or 80 or 90 minutes before breakfast, after the exercises, I start the day off with three glasses of water. I find the abdominal exercises are very valuable in making the compressor muscles of that region efficient in effecting the emptying of the colon. With this regimen, which is really very simple, I use a follow-up wash-out with a quart of water up to the splenic flexure as directed, first in the sitting posture, the fountain syringe being hung above the bathtub, and then lying on the left side, the water being at a low temperature of from 75° to 80°. The effect of this is very satisfactory, as the food in the upper part of the colon is not interfered with except intentionally on rare occasions when conditions are bad. This regimen has been hygienic and agreeable to the self-consciousness of cleanliness.

"When I took up the lactose combined with dextrine, which is not agreeable to the taste, particularly on account of the dextrine, unless properly prepared, I was not much prepossessed. I looked upon it as one more fad to be added to the long list that had been tried and found wanting. Although I used only about one half the prescribed amount of four heaping teaspoonfuls after each meal yet the result thoroughly astonished me. The action became normal as to concentration, color, freedom of passage and odor. I used but six pounds and with it I continued the old régime. But I had gone far enough to know that a new Warwick is in the field that I am convinced will knock out our old foe in a large percentage of cases, provided there is no organic impediment or weakness that can only be cured by surgery. I found that the lactose if secured from the right source (a reliable wholesale producer) will answer the same

purpose without the addition of the dextrine. Four to six heaping teaspoonfuls a day, taken with the bran, is the minimum amount that will produce any effect at my weight of 140 pounds. It should be regarded as a food not as a medicine and can do no harm in forming a habit.

"If you will pardon me, my theory of the action of this wonderful remedy in my case is that the lactose is very difficult of digestion and is thus able to reach the colon. When ice cream becomes 'sandy,' a frequent experience with manufacturers who use lactose in the milk, it is found that the grit complained of is lactose, which forms after the cream is manufactured. This fact illustrates the persistence of lactose in maintaining its identity."

Attempts to duplicate in man the results obtained in the intestine of white rats with b. acidophilus were, to use Rettger's exact words, "in a very large measure successful."

Subjects C and 1 were kept under observation for ten or fifteen days during which periods they were found to have the ordinary complex flora. Acidophilus was present but in very small numbers. Subjects A and D, who were habitual users of milk to the extent of a quart a day each, were instructed to continue its use. These subjects upon examination were found to carry a relatively high proportion of acidophilus and the amount of gas was considerably less than in the cases of C and 1. Upon removal of the milk the percentage of acidophilus dropped gradually until there was a complete reversal of the condition. This last experiment showed that acidophilus is a natural inhabitant of the human intestinal tract.

In all these experiments either lactose or dextrine was employed. They were administered three times daily in 100 gram quantities (3.2 ounces) except where the total amount was but 150 grams, when it was consumed in one dose. The lactose was taken between meals in the form of a heavy aqueous suspension (carried in water) while the dextrine was used in a 50 per cent solution by boiling. The dextrine was flavored with a little orange juice to overcome its unpleasant taste. This sugar was administered to six persons and the results were fairly uniform, effecting a radical change of flora in from four to

eight days. One subject who weighed nearly 200 pounds required 400 grams per day which brought about a complete simplification and aciduric flora within four days.

This simplification of the intestinal flora was characterized by an enormous increase in the number of acidophilus and the almost complete elimination of the ordinary bacterial types. Similar results were achieved *whether lactose or dextrin was used.* Some subjects are much more responsive to the treatment than others and require smaller amounts of these carbohydrates. In every case simplification of the intestinal flora (bacterial condition) was accompanied by a decrease in the amount of gas. All these results are in perfect harmony with those achieved with white rats.

A successful attempt was made to change the form of the lactose to milk cultures, that can be drunk like buttermilk. Owing to the fact that acidophilus is not a milk-borne organism this change was not easily accomplished. In one subject after two days of sour milk feeding to the extent of 500 cubic centimeters a day (one-fourth of a gill over a pint), at intervals, acidophilus became dominant and was practically the sole visible organism in the stools. After discontinuance of the sour milk the simplified flora gradually gave away to the ordinary mixed type, requiring about five days.

Two other subjects required a liter of sour milk a day (½ gill over a quart) to effect the desired change in the flora. Five additional subjects gave the same results.

One subject had a long history of the most obstinate constipation, only controlled by the use of drugs. Another was afflicted with diarrhea acquired in the tropics, with offensive stools. Both of these subjects responded readily to acidophilus milk. The first named had normal stools for 35 successive days on which they were examined. He said his general condition had improved. The diarrheal subject returned to what appeared to be a normal condition with complete elimination of the offensive odor.

The sour milk of acidophilus and bulgaricus differ in that the former never attains the degree of acidity in old

cultures that bulgaricus does. The former acquires a creamy but never a sticky or stringy consistency, while the bulgaricus culture has a thicker and at times a more or less slimy character, depending upon the particular strains used. Acidophilus milk has a decidedly perceptible aroma and taste which materially adds to its palatability.

Method of Preparation.—Sweet skimmed milk is sterilized by the Rettger method at 15 pounds steam pressure for 20 or 30 minutes or longer when more than 1,000 cubic centimeters, a little over a quart, are sterilized in a container, which in the present case were Pyrex Florence flasks. The cooled milk is inoculated with a pure culture of acidophilus, preferably mixed strains, and incubated (grown) at 35 to 37 C. temperature, normal temperature of the body, for 12 to 24 hours. The inoculum (milk already inoculated) should not be over 72 hours old. Recently isolated strains of acidophilus are slow and ineffective. Therefore it is necessary to employ strains that have grown in milk for at least two or three weeks and which have been transplanted from milk to milk every day. The amount of inoculum should be large, not less than one half to one per cent (that is 5 to 10 cubic centimeters or units to 1000 of milk,) in order to obtain maximum development within 24 hours. The transfers are made in sterile pipettes, from sections of glass tubing (boiled in water) drawn out and closed at one end, but the open end must be large enough to admit coagulated milk.

As soon as the milk has undergone coagulation it is placed in a refrigerator, clean and free from odors. Thus kept the milk changes very little in the course of a few days but should be used very soon.

If it is desired to reinforce the milk with lactose it can be added at the time the milk is used as food. The milk should then be well shaken and allowed to stand in a cool place. This will permit a goodly percentage of the lactose to be dissolved and thus reduce the gritty character of the lactose-enriched milk. For those who crave sugar the addition of the lactose greatly adds to the richness of the milk.

At first it will require five or six days and even more than a week for the milk to show signs of acidity and coagulation. But the coagulation time will gradually shorten until three weeks after the first milk culture is prepared coagulation should be obtained within 24 hours. At the end of the fourth week of almost daily transfers the time should be reduced to 12 or 15 hours, where it is likely to stand for many months.

Whether boiled milk may be substituted for the sterilized (above described) and the same satisfactory product obtained has not been determined. Boiled or incompletely sterilized milk must be inoculated immediately, however, before any bacterial change has taken place.

In a personal communication to the authors Professor Rettger expresses the emphatic opinion that tablets are worthless as carriers of the bacilli acidophilus and bifidus.

Embarking on a lactose diet is not always easy sailing. As lactose exists in milk to the extent of 4 or 5 per cent,[1] and as prepared is a white, very fine powder, very much like flour in appearance, with a slightly sweetish taste, one would imagine it to be a food that can easily be taken in one of several forms. And it is. But when a patient's whole digestive tract is upset by intestinal inefficiency, and to this artificial condition is added a natural stomach fastidiousness, and in addition there is an inborn awkwardness of method in going about any mechanical job, one need not be surprised to learn that certain people have difficulties in taking this new food. The mistake generally made, when such conditions exist, is to not go slowly enough in first testing out methods for adding lactose to the diet in the most agreeable form. If it is repugnant with bran and water, perhaps it can be sprinkled over the cereal before the milk or cream is added, thus enriching the milk. A part at first can perhaps be taken with the bran, when the latter is taken in water and promptly swallowed. The amounts to be consumed per diem being fairly large, as we have just seen, this little problem must be thought out and tried out in advance. Some patients can achieve gratifying results within two or three weeks with two heaping teaspoonfuls

[1] Hutchinson's "Food and the Principles of Dietetics."

twice or thrice a day, with meals, or even once a day after being so taken for a week or two. Others require twice this much or more. If the recommendation of McCollum that every person should drink a quart of milk a day is adopted, then this vehicle could be utilized in carrying a large part or all of the daily amount of lactose consumed divided in three glasses of milk, one with each meal. If so the method of drinking the milk slowly, or sipped as advised by Kellogg, should be practiced. In spite of all care, however, the body may give signs occasionally of having consumed too much carbohydrate food. If so, instead of cutting down the lactose starchy foods may be reduced—for instance bread and potatoes; or, during the period of adaptation the lactose can be omitted for a few days, or taken in quantity of two or three heaping teaspoonfuls at breakfast only, particularly where the object is limited to the eradication of putrefaction. If so, a cumulative effect, indicated by the physiological odor of lactose, should be established in a week or two. Then this result can be made permanent by continued use, and enlarged *or* intermittent use, which will insure the steady periodical *reinforcement* of the antiputrefactive micro-organisms in the colon. Such limited use of lactose will in many cases require the help to be derived from bran, abdominal exercises, regulated diet, plentiful outdoor exercise and early morning water drinking up to three glasses. One of the great benefits attaching to this last item, as amplified elsewhere, is the dilution of the urine and the relief of the overburdened kidneys.

Writing of the possibility of banishing "wild" bacteria (putrefactive) by the milk diet taken in large quantities (a glassful every half hour, under restrictions), sipped slowly or taken through a straw, the natural lactose in the milk being strengthened by dilution with water and the addition of two ounces of lactose, to the quart of milk, a method we are not concerned with here except in its relation to lactose, Kellogg says the results are gratifying. The tongue becomes clean, the breath sweet, the feces are no longer offensive and usually have a yellow color, little odor, or a slightly sour odor. This change is

generally observed within a week or ten days, and even sooner when the bowels move more freely. The skin clears, the blood improves, the patient gains in flesh, often a pound a day, and the old depression, headache, mental dullness and other miseries are replaced by a sense of energy and well being. The transformation of the patient from the poor, emaciated, despairing invalid to a plump, rosy cheeked, bright, forceful person is often so rapid as to seem almost miraculous. This rejuvenating process sometimes continues for two or three months if the regimen is faithfully carried on and modified to meet the patient's changing needs. A gain of twenty five to thirty pounds in six or eight weeks is not uncommon.[1]

Lactose in exceptionally large doses is a mild diuretic (increases the amount of urine), particularly with elderly people with irritable kidneys. As the purpose of lactose is to develop the micro-organisms acidophilus and bifidus in the colon, the effect will be the same if they are introduced directly by the use of buttermilk inoculated with them.

[1] "New Dietetics."

Note to Third Edition

Keep a bowl of this sugar on the table and use it freely on cereals, fruit, etc., and particularly in milk; four to six heaping teaspoons, in ordinary cases, a day. The publishers have made arrangements to supply readers of "The Lazy Colon" with the fresh product of a leading New York chemical house, *in 5 pound packages*. Price, including delivery charges: for New England, New York, Pennsylvania, Michigan, Ohio, Virginia, West Virginia, New Jersey, Delaware, Maryland, North Carolina and Canada, $2.47. All other states, $2.72. In a moderate case of stasis 5 pounds generally lasts for from 40 to 50 days.

Note to Sixth Edition

Signs of too much carbohydrate foods (starches and sugars), referred to on page 222, are the same as when too much of any kind of food is eaten, and the remedy is to eat less. The carbohydrates that should be eaten most freely are vegetables and fruits. Those which are apt to give trouble are underdone, fresh bread and tough griddle cakes (see pages 230–31) and such mixtures as starch, sugar, and "shortening."

Chapter XXIX

SOME INTERESTING FACTS ABOUT FOOD

There are many unhacknied facts on the subject of diet, some of which are assembled in this chapter.

If a weak, half per cent solution of boiled starch is taken into the mouth and kept there for but 20 seconds and then expelled into a test tube, it will be found that the starch has disappeared and that in its place is sugar. It is evident that saliva will have but a short time to act upon the food but the action is continued for a while in the stomach, 20 minutes being sufficient to convert the greater part of the cooked starch into dextrine and sugar.[1]

The sugar of ripe grapes is simple or invert sugar and consists of equal parts of glucose, or grape sugar, and fructose or fruit sugar. When fermentation occurs in the compound sugars, such as cane or malt sugar, these are first converted by ferments in the digestive fluids to the simple sugars, glucose and fructose. If grape sugar be taken with the food it is absorbed into the blood without change.[1] Kellogg says the sugars of honey are levulose and glucose, in about equal parts.

Cereals a Poor Food.—The consumption of cereals to the extent of 35-40 per cent of the food supply, as is now the rule in parts of Europe and America, is an innovation in human experience. There are two kinds of evidence available in abundance which point unmistakably to the belief that we have already exceeded the limit of safety in this regard unless careful attention is given to the remainder of food supply (particularly the addition of milk and the leafy vegetables, like spinach). These

[1] Starling, "Action of Alcohol on Man" (1923).

two kinds of evidence are (a) the overwhelming knowledge of the debilitating effects on animals of such diets as are now in common use by many families—the white bread, meat and potato type of diet. Milled cereals have, it will be observed, essentially the same dietary properties as bolted flour. (b) The great increase in certain physical defects in man in recent times, the principal features of which are easily reproduceable in animals by defective diets. We need only mention retardation in growth of children, faulty posture, tendency to nervousness and irritability, defective teeth and faulty skeleton development. No one will be likely to dispute the statement that most people are unwell. Under faulty nutrition the machinery of the body tends to break down in places and with frequency.[1]

The validity of the conclusions drawn from human experience and animal experimentation has already been verified in several places by the scientific feeding of school children. Notable among these are the triumphs of Mrs. Ira Conch Wood of Chicago,[2] and Miss Maude A. Brown of Kansas City.[3] These results have been obtained essentially by liberal feeding of milk to undernourished children who have had a bad start in life, with retarded growth. The corrected dietary tends to overcome the injurious effects of diseased tonsils, poor and infected teeth, tympanitic abdomen (distension of abdominal walls with gas), poor posture, diseases of the eye, enlarged glands, râles (bronchial or lung sounds). In Kansas City each child received from 1 to 2 pints of milk with cereal and fruit every day. The remainder of the food up to 1000 to 1200 calories (totaling the daily rations for a child) was supplied in soups, vegetables, sandwiches, frequently cocoa, and occasional treats of cookies and milk chocolate.[3]

Cheese as a Food.—The difficulty in the digestion of cheese lies in the fact that it is permeated with fat and

[1] McCollum, "Newer Methods of Nutrition."
[2] Elizabeth McCormick Memorial Fund Publication, Chicago.
[3] "A Study of Malnutrition of School Children," *Journal American Medical Association*, 1920, p. 27. Report by Miss Brown. Approved by McCollum.

this forms a coating to the cheese particles that does not easily permit the union of the gastric juices and the casein (of milk), a form of protein which is the real substance of the cheese. The dryer the cheese and the finer it is grated the easier it is digested. A better plan in preparing it for food is to dissolve the cheese and then mix it with some other form of food, such as slices of toasted bread. Casein forms a soluble compound with the alkalis. An able writer [1] says that as much bicarbonate of potash as will lie on an English 3-penny piece (a silver coin smaller than the American dime) is sufficient to dissolve a quarter pound of finely grated cheese. By the addition of milk and eggs a fondu can be prepared at small cost. It is only in the stomach that the difficulty of digesting cheese occurs. Once in the intestines nearly 90 per cent of the energy is available.*

Cream or cottage cheese, when freshly made, is more wholesome than meat and more nutritious. According to Williams 20 pounds of cheese contains as much nutrient as the carcass of a sheep weighing 60 pounds. Cheese contains more fat and more protein than beef and less than half as much water. The energy value of an ounce of cheese averages about 135 calories. Even cottage cheese from skimmed milk has more than half the food value of a sirloin steak of the same weight. Cheese is also rich in essential vitamins which are lacking in meat, and contains a rich store of food lime which is almost absent in meat. Cheese poisoning is due to tyrotoxicon. Vaughan made a special research into the cause of between 300 and 400 cases of cheese poisoning occurring in

[1] Heretofore commended, Prof. Mattieu Williams in his "Chemistry of Cookery."

* *An excellent recipe for cheese fondu:*

1 cup fine, dry bread crumbs.
1 cup dry, grated, sharp cheese.
1 large spoon melted butter.
3 eggs well beaten.
2 scant cups rich milk.

Stir bread crumbs into the milk, add a pinch of soda, then the well-beaten eggs and seasoning. Stir in cheese last, bake in rather hot oven twenty minutes to a half hour, serve immediately to prevent falling. If failure comes it is likely to be from not having the bread dry enough to grate, the cheese strong enough to give a flavor, or the eggs not beaten light enough. For 6 people.

the state of Michigan and found them due to the above cause. Cheese containing this poison does not differ in appearance from ordinary cheese but cats and dogs refuse it.* In the matter of foreign cheeses Adametz estimated the bacteria present in cheeses like Camembert, Roquefort, Gorgonzola and Stilton number 25 million to the ounce. Roquefort is made by adding to the curd of milk mold from a dough made from barley flour with which yeasts and sometimes vinegar has been mixed. The mold which forms on this dough when allowed to stand is rubbed into a powder and added to the milk. Einhorn has shown that these molds sometimes take up their abode in the stomach, form colonies and thus become a cause of grave disease.[1]

Eggs.—Kellogg is of the opinion that the eating of eggs needs careful supervision. The whites of five eggs given to a 15 pound dog caused very offensive discharges with much mucus, indicative of putrefaction. Even when small amounts of raw white of egg are eaten unchanged albumen can be recovered. According to Prof. Linossier, a member of the Academy of Medicine of Paris, there is in eggs a toxic form of albumen (white of the egg) to which some people are susceptible either by heredity or through acquirement as the result of disorder of the liver or intestines. This poison, according to Linossier, is destroyed by heat. These peculiarities disappear when it is cooked at a temperature of 160° F. Egg yolk is very digestible whether eaten raw or cooked. The giving of raw eggs to invalids, with or without milk, and the giving of white of egg to infants should be discontinued. In fact the egg in any form, as so frequently used in the sick room, is under suspicion and must be eaten in moderation and with caution to make sure that it is fresh and free from infection. Many persons cannot eat any part of an egg without most unpleasant consequences, among them nausea, vomiting, purging, head-

* In Wisconsin and other states, where cheese is made by families, later to be gathered up by distributors, the hygienic conditions are reported at times to be very bad (special communication). Factory cheeses of well known makes only should be used.

[1] Kellogg, "New Dietetics."

ache, and nettle rash. A good way of boiling eggs is to drop three in a quart of boiling water. Remove at once from the source of heat. In ten minutes the eggs will be found to be uniformly soft-boiled or "jellied." If eggs when eaten happen to be a little stale the resulting putrefaction and intestinal intoxication are greatly intensified. When eggs are used as a source of food-iron, to enrich the blood in anemia, it is the yolk only that is useful. As a source of iron the egg yolk supplies the iron deficiency in milk. Half an ounce of egg yolk contains a little more than 2/5ths of a grain of lime. The yolk contains per ounce nine times as much lime as the white. But the lime of a glass of milk equals that of three or four eggs. An ounce of chard (Swiss lettuce) nearly equals two egg yolks in the amount of lime contained and even celery furnishes as much lime as the same weight of yolks, while an ounce of turnip tops supplies as much lime as the yolk of four eggs and an ounce of mustard greens as much as a half dozen yolks. Fresh milk and fresh eggs are highly preferable to meat as sources of animal protein. Meat is wholly lacking in lime and its iron is inferior. Milk is rich in lime salts and both eggs and milk are rich in essential vitamins. Persons suffering from Bright's disease, or who have albumen in the urine should avoid the use of eggs or should, at least, eat no more than the yolk, which is readily digestible even when hard boiled.[1]

John Burroughs, the noted naturalist and author, said he was in his 70's before he learned that a certain form of illness he had suffered from at intervals all his life was due to eggs. He acquired his information from a chance reading of a book on Nutrition by Prof. Chittenden of Yale.

Since the investigations of Rettger[2] it is known that a large percentage of all eggs show bacteria. The yolk is infected more than the white. The U. S. Government investigations report, says Kellogg, one egg in seven, on

[1] "New Dietetics."

[2] Leo F. Rettger, Laboratory of Bacteriology and Hygiene, Sheffield Scientific School, Yale University.

the average is infected with harmful bacteria, which are only destroyed by thorough cooking. The yolk of a hard-boiled egg should be cooked until it can be crushed into a mealy state by a fork.[1]

Value of Milk as Food.—Milk is not only the most perfect human food but is unsurpassed as a nutrient medium for the growth of bacteria. Hence it is very likely to become unwholesome unless it is properly handled. In hot countries and among pastoral peoples who live under primitive conditions the practice is to promptly sour all milk through the aid of lactic acid-producing bacteria. This protects the milk against unwholesome decomposition, because the rise of acidity is so rapid that all forms other than the acid-forming organisms and certain yeasts are killed or their growth prevented. Sour milk is a highly wholesome food and is used in enormous quantities in Asia, Arabia, the Balkan States, Northern Africa, and in the grazing sections of Abyssinia.[1]

If milk is pasteurized, as is the practice in America, great care must be exercised in the matter of cleanliness, and refrigeration. City milk supplies can be pasteurized by heating for 30 minutes to a temperature of 145 ° F, with prompt cooling and bottling in sterile containers.[1]

Simple Diet.—"It is my conclusion that more than one half of the chronic complaints which embitter the middle and latter part of life among the middle and upper classes are due to errors in diet. . . . I advise more emphatically than ever simplicity of diet. Not only should the quantity of food taken be gradually diminished in proportion to decreased activity of body and mind, but no more than two or three kinds of food should be served at any one meal. . . . No one should permit himself to become the subject of obesity in advancing years; and almost invariably it is his own fault if he does."[2] "The average man with ordinary

[1] "New Dietetics."

[2] Sir Henry Thompson, F.R.C.S., London. Noted English surgeon. Author of twelve works on surgical and medical subjects. Quotation is from "Diet in Relation to Age and Activity."

habits of diet consumes more nitrogen (the essential element of protein food) than the body can possibly make use of "because the actual need of nitrogen is so small that an excess is always furnished with the food."[1]

Condiments.—Mustard, pepper, pepper sauce, cayenne, horseradish and the whole list of hot, irritating concoctions that are frequently added to food as seasoning, become more and more concentrated in the lower part of the small intestine and colon as the food substances with which they are eaten are digested, leaving the indigestible parts of the condiments behind. These substances produce at first irritation, then catarrh of the stomach and intestines, leading to inflammation of those organs and later to the degeneration of the gastric glands. They are one of the causes of constipation and, as a consequence, of acute and chronic appendicitis, catarrh, hemorrhoids, and ulcers.[2]

Cancer of the colon constitutes about nine per cent of all cancers, the most frequent locations being in the cecum and ascending colon and in the pelvic region, points where the greatest delay and hence the greater irritation occur.[2]

Vegetable and Meat Proteins.—It was as late as 1900 before sound views began to develop as to the differences in the nutritive value of proteins derived from different sources. Prior to that time protein from one source was deemed as good as that from another. Beans and peas, for example, contain about 23% of protein and compare favorably on this point with lean meat. We now know that these vegetable proteins have peculiarities in their composition which make them of relatively low value in nutrition.[3]

Brown Bread or White Bread.—Wheat flour is very deficient in the vitamins A, B and C.[4] Both whole wheat and white flour bread need to be carefully supplemented

[1] Otto Folin, biological laboratory of Harvard Medical School. Author of many papers on urine analysis in metabolism (digestion and utilization of foods) and blood analyses.
[2] Kellogg, "Colon Hygiene."
[3] Digested from McCollum.
[4] Chick and Hume.

by other properly selected food. Milk and the thin leaves of plants are of especial worth in enhancing the dietary values of nearly all other foods and they are therefore of particular importance. In a lesser degree eggs and the glandular organs of animals serve this purpose of improving the quality of cereals, tubers, fruits, roots and meats of the muscle type, but they lack sufficient calcium.[1] Of common articles of diet the richest in calcium is milk.[2]

A comparison of the qualities of whole wheat, graham, rye and white flour bread:

	Water	Protein	Fat	Carbohydrates
Whole wheat bread, pure, average of 6 samples	33.8	10.55	1.21	53.4
White bread (baker's)	34.2	8.8	1.4	53.7
White bread (homemade)	30	9.1	3.0	56.9
"Brown" bread (baker's)	32.5	8.8	2.4	55.3
Graham bread (homemade) ...	34.2	9.3	3.2	51.8
Rye bread (baker's)	36.7	8.1	0.5	54.0
Whole wheat bread (baker's) ..	32.3	11.6	0.6½	54.2

Bolted white flour consists essentially of starch, protein and inorganic salts. Its protein is of relatively poor quality and its mineral content is conspicuously lacking in calcium, chlorin, iron and phosphorus, essential elements we expect to find in our foods.[1]

The proteins of bolted flour are practically limited to gliadin and glutinin. They cannot be utilized as body proteins unless they are combined with other foods wisely chosen.[4]

Bolted white flour has excellent keeping qualities. When properly combined with other foods to make a well proportioned diet, every factor adjusted to meet needs of the body, it becomes an entirely satisfactory part of the diet to people of normal digestion. Whole wheat flour is decidedly more suitable to maintain well-being for a short time if it serves as the sole food. It also is a decidedly incomplete food and needs to be properly

[1] McCollum.
[2] Bulletin 67 U. S. Dept. Agriculture.
[3] Digested from several authorities.
[4] Chick and Hume (English).

supplemented. Dyspeptics who rely on it for a palliation of their symptoms should seek relief through a carefully balanced diet nicely adapted to their needs.[1]

Starch Indigestion.—The main sources of starch, says Russell, are cereals, rice and potatoes; of protein, meat, milk and eggs; of fat, butter, milk and meat. Starches are unfit for human food in an uncooked state. Cooking breaks down the starch capsules and disintegrates the starch particles so as to expose them to the digestive activity of the saliva and other secretions. Long cooking at a low temperature (140° to 165° F.) greatly facilitates speedy conversion. This process continues in the stomach until by the pouring out of hydrochloric acid the gastric contents acquire an acidity of 3-100ths of 1 per cent, according to Chittenden and Smith. When this acidity reaches a certain degree the digestion of starch ceases, but the digestion of proteins, already begun, is accelerated by the increase of hydrochloric acid and pepsinogen (secretion of the stomach changed into pepsin by hydrochloric acid). These three chemical phenomena—starch digestion, arrest of same and protein digestion—are those upon which the unconscious comfort or conscious discomfort of digestion depends. The disturbing factor is the hydrochloric acid. Protein elements in the food are digested with alacrity and it might be thought that the finely divided starch particles would also readily pass out of the stomach with the protein. But a considerable portion of *unaltered* starch is retained in the stomach. The physiological concept is that the undigested starch readily passes into the duodenum (first section of the small intestine immediately below the stomach) and that its digestion is completed in the intestine, but only after much discomfort which may result in rejection of the material by vomiting. There may be a considerable percentage of milk fat present from which the casein has disappeared. As gastric secretion continues an excess of hydrochloric acid may develop, as there is no element present with which it can combine, thus developing a high degree of acidity.

[1] McCollum.

Once the residuum of the starch becomes very acid it cannot escape because of the closure, sometimes by spasm, of the lower end of the stomach (pylorus). That the cause is not disordered nerves as set out by some authors, our author says is proved by the instant relief caused by emptying the stomach, sometimes by dilution with drinking water, or by the administration of neutralizing remedies, such as baking soda. (See page 16 herein). Where there is the other condition, of a deficiency of hydrochloric acid, a tonic laxative like cascara is indicated in small doses after each meal or in a larger dose at night. Many cases are benefited by a course of acids, such as dilute hydrochloric acid or fruit acids, which are generally craved, and a course of bitter tonics, such as quassia or the more aromatic gentian. Meat should be strictly limited and finely divided and the starches properly cooked for easier digestion. For instance, where it has been the habit to stir raw flour into batter cakes the flour should be first cooked at a slow heat in the oven, and oatmeal receive a slow cooking of 2 or 3 hours. The griddle cakes can be further greatly improved as to digestibility by being made of sour milk and very little soda, not enough to destroy the sub-acid of the cakes. With the batter made very thin, so that the cakes are difficult to remove from the griddle, a much-liked product, fit for the human stomach, is produced. The necessary amount of pre-cooked flour in a bowl should have salt added and the yolk of one egg for each two cups of flour or less; to be thinned with thick sour milk or buttermilk. To each cup of milk there is to be added the scant half of a leveled, small teaspoon of soda dissolved in a little warm water. There should be no taste of the soda in the cakes. The pre-cooking of the flour adds to the popularity of the cakes, even when it is slightly browned.[1]

Swedish bread.—This is a light brown, hard-baked bread, about the size and shape of a victrola record but somewhat thicker. It is much relished by many people,

[1] Sir William Russell in *Stomach and Abdomen* (1922) and Professor Mattieu William's *Chemistry of Cookery.*

partly on account of its laxative effect, and is made up of the whole rye grain crushed. It can be broken up and used as a cereal with cream.

Apples.—Many people improve their health by eating every day, particularly at breakfast well-ripened raw apples, the acidity of which assists in the action of gastric juice; it also stimulates the flow of pancreatic secretion, which acts as a solvent of almost all food constituents. Sir William Osler called the attention of Sir Hermann Weber (whom we are quoting) to a passage in "Laurentius" to this effect: ". . . and especially those apples which have a marvelous propertie in curing melancholy." Apples contain a larger proportion of soda salts than pears, which are richer in potash salts. A winter apple should be in a month or two off the tree before it is fit to eat; then it is relatively easy of digestion.[1] (See reference to apples under vitamins.) Apple sauce should be on the breakfast table the year round, made with little sugar, little water and not cooked until it is mushy. In other words it should be distinctly sub-acid. A little cinnamon sprinkled on top adds flavor.

Salt.—Sir Hermann Weber remarks that in cases of renal (kidney) disease one often sees the disappearance of dropsy result from a comparatively saltless diet. He further observes that in most people the tendency to eczema is increased by the use of much salt; when used freely it increases the blood pressure and is therefore likely to promote arterio-sclerosis. With high blood pressure the use of salt should be restricted.[1]

The use of salt, Kellogg says, raises the blood pressure. When salt is removed from the body by copious water drinking or by profuse sweating the blood pressure falls. Dropsy is produced in a large percentage of cases by the accumulation of salt in the tissues. Many observations have shown that the kidneys fail to remove salt at the usual rate in various diseases, particularly in

[1] "Longevity."

pneumonia, pleurisy, Bright's disease, some forms of heart disease, erysipelas, typhoid fever, jaundice, cirrhosis of the liver, scarlet fever, small-pox, and dropsy. Hence in these disorders salt should be withheld or at least greatly reduced. Salt is merely a concession to an artificial appetite. A herd of tame deer on the author's place that had never been given salt refused to touch it when the naturalist Seton Thompson offered it to them. M. Achard and Professors Strauss, Weidall, Lemierre and Javal found in cases they investigated that albumin was made to disappear from the urine by withholding salt. The great importance of this discovery can only be appreciated when one considers the enormous and indiscriminate use of salt by a large percentage of persons in this country.[1]

Honey.—Cane sugar, says Fischer,[2] should be eaten only in moderation. Otherwise it causes acidity and gives rise to gastric catarrh and indigestion. Grape sugar, such as that of honey, raisins, figs, fruit and malt sugar, is wholesome. Comb honey is laxative. Some persons well known to Weber [3] ascribed their good health to the regular use of honey at breakfast. Comb honey was largely used by the ancients.

Many people who eat large quantities of cane sugar especially with cereals, where it often develops fermentation, will be surprised to know that if grape sugar and fruit sugar are introduced into the blood they are directly utilized by the body, whereas cane sugar when so injected is unaltered by the liver and excreted by the urine. When eaten it must be changed into grape sugar before it can be utilized.

Genuine honey is a food like none other; the sugars in it are directly assimilable. It imparts to the human economy more fuel value than meat or eggs. The energy or fuel value of an egg is 83 calories, while an ounce

[1] "New Dietetics."

[2] Martin W. Fischer, professor of Physiology, University of Cincinnati. [3] Weber's "Longevity."

NOTE TO THIRD EDITION.—A most excellent honey can be obtained of the Tongue River Apiaries, Ranchester, Wyoming, 2½ lbs., 75 cents; 5 lbs., $1.40, prepaid by mail, by producer.

of honey furnishes 95 calories. The formic acid it contains prevents fermentation and its accompanying symptoms of flatulence and toxemia. An analysis shows that while sugar contains no lime or iron, honey has 6.70 per cent of lime and 1.20 per cent of iron.[1]

COMPOSITION OF FOOD MATERIAL

Food	Protein	Fat	Carbohydrates	Food value per lb. (in calories)
Beef, round	19.0	12.8	...	890
Beef, dried	26.4	6.9	...	790
Ham, smoked	14.2	33.4	...	1635
Chicken	13.7	12.3	...	765
Eggs	13.1	9.3	...	635
Fresh cod	11.1	0.2	...	220
Oysters	6.0	1.3	3.3	225
Butter	1.0	85.0	...	3410
Cheese	25.9	33.7	2.4	1885
Milk, whole	3.3	4.0	5.0	310
Milk, skimmed	3.4	0.3	5.1	165
Oatmeal	16.7	7.3	66.2	1800
Rice	8.0	0.3	79.0	1620
Rye flour	6.8	0.9	78.7	1620
White flour	11.4	1.0	75.1	1635
Graham flour	13.3	2.2	71.4	1645
White bread	9.2	1.3	53.1	1200
Graham bread	8.9	1.8	52.1	1195
Macaroni	13.4	0.9	74.1	1645
Sugar	...	...	100.0	1750
Corn starch	...	...	90.0	1680
Beans, dried	22.5	1.8	59.6	1520
Beets	1.3	0.1	7.7	160
Cabbage	1.4	0.2	4.8	115
Potatoes	1.8	0.1	14.7	295
Sweet potatoes	1.4	0.6	21.9	440
Tomatoes	0.9	0.4	3.9	100
Spinach	2.4	7.5	3.6	34.9
Apples	0.3	0.3	10.8	190
Bananas	0.8	0.4	14.3	260
Oranges	0.6	0.1	8.5	150
Strawberries	0.9	0.6	7.0	150
Almonds	11.5	30.2	9.5	1515
Brazil nuts	8.6	33.7	3.5	1485
Chestnuts	5.2	4.5	35.4	915
Walnuts	6.9	26.6	6.8	1250

[1] "Dietotherapy," 3 vols., Appletons (1922), quoted from Prof. Reclam, of Switzerland.

American reports vary to such an extent, owing to different units used, that the above table was taken from the Encyclyopedia Britannica, vol. 8, p. 216, except the spinach, which is from a U. S. Government report. If butter is added to potato or cream or milk to oatmeal or strawberries of course their food value can thus be greatly improved.

Calory.—The method of standardizing food by the caloric method is very simple. One has merely to multiply the percentages of protein or carbohydrate it contains by 4.1 and the percentage of fat by 9.3 to get the total calories or combustible value of 100 grams of food.[1]

A specimen of 100 grams of milk that contains 2 per cent of protein, 4 of fat and 6 of carbohydrates will yield

Protein	$2 \times 4.1 = 8.2$
Fat	$4 \times 9.3 = 37.2$
Carbohydrate	$6 \times 4.1 = 24.6$
	70.0[1]

"Combustible value" as used above means that a calory is the measure of heat derived from food when dried and burned. Thus a calory is the amount of heat required to raise one gram of water (about ¼ of a teaspoonful or 1 cubic centimeter) 1 degree Centrigrade in temperature.

[1] Hutchinson's "Food and the Principles of Dietetics," Wm. Wood & Co. (1922).

Chapter XXX

NEW LIGHT ON LONGEVITY

Of the 8797 descendants of William Hyde, of Norwich, Conn., who died in 1681, a written record exists of the birth, marriage and death of 2958. So far as the Hyde strain is concerned these descendants rapidly lost, of course, everything but a mere trace of that blood. The first generation owed a half to each parent, the grandchildren a quarter to each, while as early as the seventh generation but one-sixty-fourth of the original strain remained.

Alexander Graham Bell studied these records with great care and derived some very interesting facts. A majority died long before their 50th year. Those whose parents died before the age of 60 had an average life of 32.8 years. Where both parents lived beyond 80 the average of the children reached the maximum of 52.7 years. If the father lived to be over 80 and the mother died under 60 the average age of the children dropped to 42.3 years. Where the case was reversed and the mother had a span of 80 years or over with the father dying under 60 the average age of the offspring dropped to 36.3. At the age of 5 nearly one fourth of the entire number had died (male survivors 75.5%, female, 77.9%).

The age of the mother had much to do with the length of life of offspring. The youngest mothers, even down to 18 years of age, had the best record. The average length of life for the offspring of mothers under 25 was 38.7 years; of mothers between 25 and 30, a fall to 36.6 years; from 30 to 35, 33.6 years; 35 to 40, 33.6 years; 40 and over, 28.1 years. Those born less than 10 years after marriage had an average duration of life in 1,723 cases of 35.5 years. Those born between

10 and 20 years after marriage in 847 cases lived on the average 33.3 years; those born 20 or more years after marriage in 187 cases had an average life of 28.3.[1]

These Hyde facts are not based on a selected list, such as accepted risks of an insurance company, but include all who were born alive, as is the case with the United States Census. The latter deals with both the white and colored races, and people of native and foreign birth. Nevertheless it will be interesting to compare the crude census and Hyde figures.

The number of people *out of 100 who died each year* up to the age of 75, in which the Hyde figures for 1,606 males and 1,352 females are compared with the United States Census figures for 1920 on a distribution per 1,000:

Age at Death	Hyde Per Cent Male	Hyde Per Cent Female	Census Per Cent[2] Male	Census Per Cent[2] Female
Under 1 year	8.8	6.6	16.5	13.8
1 to 2 years	8.0	7.2	3.2	3.1
2 to 3 years	3.9	4.0	1.4	1.4
3 to 4 years	2.4	2.4	0.9	1.0
4 to 5 years	1.4	1.9	0.7	0.7
Total under 5	24.5	22.1	23.0	20.3
5 to 10 years	3.9	5.2	2.4	2.3
10 to 15 years	2.2	3.5	1.7	1.6
15 to 20 years	3.3	5.6	2.6	2.8
20 to 25 years	7.3	7.1	3.3	4.3
25 to 30 years	5.4	6.7	3.8	4.9
30 to 35 years	4.6	6.1	4.1	4.6
35 to 40 years	4.4	5.6	4.5	4.5
40 to 45 years	3.9	5.2	4.2	4.0
45 to 50 years	5.1	4.4	4.7	4.3
50 to 55 years	5.1	4.0	5.3	4.7
55 to 60 years	4.4	3.2	5.6	5.1
60 to 65 years	4.3	4.1	6.6	6.0
65 to 70 years	4.9	3.1	6.8	6.5
70 to 75 years	5.1	4.0	6.9	7.0

The accuracy of Bell's figures cannot be successfully attacked. Such differences as appear can be largely accounted for by the gradually lowering death rate since

[1] "The Duration of Life," privately printed (1918).
[2] Mortality Statistics Census 1920, for the death-registration area.

1681 resulting from improving methods of living and fighting disease since those pioneer days.

Life Insurance Experience

We now shift to another source of information, the investigation carried on by 43 of the largest life insurance companies in the United States and Canada, from 1909 to 1913, in order to secure more reliable data for the construction of life insurance tables. We are now dealing with insured lives—selected risks. The last of four large volumes of tables of this highly important actuarial and medical investigation did not come off the press until 1922. Some of this information is of great public interest, particularly to the many who desire to be informed on the question of preserving health and prolonging life.

The standards of weight of the human body were drawn from 221,819 male risks and 136,504 female risks as follows:

MEN			WOMEN		
Height	25 to 30 Weight	50 and over Weight	Height	15 to 19 Weight	50 and over Weight
5.0 feet	125 lbs.	135 lbs.	5.0 feet	112 lbs.	133 lbs.
5.3 "	131 "	142 "	5.4 "	123 "	144 "
5.6 "	142 "	153 "	5.8 "	138 "	163 "
5.8 "	150 "	163 "	6.0 "	155 "	177 "
5.10 "	158 "	173 "			
6.0 "	169 "	184 "			
6.2 "	181 "	198 "			
6.3 "	187 "	205 "			

Those who had an *underweight* of 25 pounds or more at the ages of 25-30, when their insurance was taken out, were found to be extra-hazardous risks of 20 per cent above expectation; those between 30 and 50, with the above underweight, at the time they were insured, had an excess death rate of but 1 per cent; while those whose policies were taken out at ages 50-60 showed a death rate of 12 per cent under expectation.

Where the weight was in *excess* up to 45 pounds the 20-30 year class showed an excessive death rate of over

9 per cent, while the 50-60 class ran up to an excess of 20 per cent.

With an *overweight of* 50 pounds or more the 20-30 year class reached an excessive death rate of over 14 per cent; the 50-60 year class, 20 per cent.

Where there was an overweight combined *with abdominal girth greater than chest expansion,* four groups were derived: up to 1 inch abdominal excess; up to 1¼ to 2 inches; up to 2¼ to 3 inches; over 3 inches. From these groups a table is derived showing a comparison of relatively high mortality for the four groups combined, all of them, it will be noted, showing an excess of abdominal girth over chest expansion: overweight averaging from 5 to 15 per cent, excess of actual to expected deaths, 114 per cent (the normal average being 98 per cent); from 15 to 25 per cent, excess 129 per cent; from 25 per cent to 35 per cent, excess 136 per cent; from 35 per cent to 50 per cent, excess 165 per cent; above 50 per cent, excess 228 per cent of actual over expected deaths.

In *tall* risks, from a height of 5 feet 11 inches to 6 feet 2 inches, where the party insured was between 20 and 30 years of age, it was found that in an *underweight* of from 25 to 45 pounds, there was an excess mortality over expected deaths of 29 per cent; with an underweight of from 10 to 20 pounds, an excess of 19 per cent; with an *overweight* of 25 to 45 pounds, an excess over expected deaths of 33 per cent; with an overweight of 50 to 85 pounds, an excess of 22 per cent. With the age advanced at the time the policy was taken out to 40 to 50 years (same height) a *deficiency* in weight of 25 to 45 pounds brought an excess death rate over expected deaths of 8 per cent; of 10 to 20 pounds an excess of 2 per cent; an *overweight* of 25 to 45 pounds, an excess over expected deaths of 27 per cent; of 50 to 85 pounds an excess of 51 per cent.

Commenting on the above figures the committee later says that in the younger ages tall men are proved less desirable risks than short men; at the older ages the short and medium-sized men are slightly worse risks than tall men.

It should be noted that these weights and heights are not set out as being anything more than the records of people who have been accepted by insurance companies, and, to that extent, indicative of the truth as to insurable lives.

Much comfort can be derived by those persons with bad inheritance in the matter of longevity and those who are overweight by the remarks of Weber[1] who mentions five cases in which he advised a corrective treatment, beginning with his own.

Case 1.—My mother died before she was 60 from weakness of the heart inherited from her father and grandfather, which led to frequent attacks of bronchitis and general dropsy. My father died likewise in his 60th year from cerebral apoplexy (rupture of a blood vessel of the brain). He had not been an abstainer himself and his forefathers for four or five generations had taken largely the strongest kinds of hocks and port and died of affections of a gouty nature, including one of paralysis and one of apoplexy, mostly under 71 years of age. By moderation in eating and drinking and abundant exercise of both body and mind, including walking, climbing and deep breathing exercises, I have escaped death from these causes, have greatly prolonged my life and am now in good health in my 95th year.*

Case 2.—Nearly sixty years ago a gentleman of the age of 41 consulted me who suffered from frequent attacks of bronchial catarrh, weakness of the heart, was rather stout, had a sedentary occupation, avoided active exercise, took much meat, and was inclined to constipation and bleeding piles. His father had died from "chronic bronchitis with dropsy" at the age of 61, his paternal grandfather from "bronchitis and congestion of the lungs" at 64; while his mother, belonging to a rather short-lived family, had died from "pneumonia"

[1] Sir Hermann Weber, M.D., F.R.C.P., an excellent English authority, Consulting Physician to the German Hospital and the National Hospital for Consumptives at Ventnor, author of "Longevity and Means for the Prolongation of Human Life" from which we quote.

* Sir Hermann Weber died Nov. 11, 1918.

aged 59. By reason of great moderation in eating, especially of flesh foods, and drinking, with attention to the bowels, by living much in the open air and in well-ventilated rooms, by regular walking and deep breathing exercises, the tendency to bronchial catarrh, to constipation and to piles was checked and he lived to the age of 75, dying of a severe attack of influenza. Three brothers and one sister, who had not followed similar régimes, but had indulged themselves more or less, like their ancestors, died before they were 60, from chronic diseases of the heart or of the lungs.

Case 3.—In 1862 I saw a gentleman, aged 44, whose father and grandfather had died under 64 from apoplexy; while his mother, who had belonged to a fairly long-lived family, had lived to 69. The patient, who was in the habit of eating and drinking freely, was of a florid complexion, muscular, slightly above the average weight and had had two severe attacks of gout. He was induced to diminish the quantity of meat to a very small amount, and to limit it further to but two days in the week, to substitute for the decrease of flesh food a larger allowance of cheese, of green vegetables and fruit, to give up stimulants almost entirely, to walk every day increasing up to a period of several hours at this exercise, and to practice deep breathing. The result was that after some years the gout had disappeared, his general health became perfect and he was able to enjoy intellectual and social pleasure up to 78 years of age, when he began to show signs of weakness of the heart after an accident which prevented his usual exercise. The final cause of death was pneumonia. Two brothers and a sister, who had indulged their appetites and taken little exercise, died between 60 and 66 from apoplexy, and others at earlier ages from bronchial attacks and failure of the heart.

Case 4.—A still more striking case was that of A. C., a member of a family of five sons and five daughters who, at 35, consulted me for weakness, shortness of breath, especially after lunch, and frequent sleepiness, particularly after meals. His family history was very grave. His father had died at 49 from bronchitis; his

paternal grandfather at 49 from bronchitis; his paternal grandmother at 55 from pneumonia; his mother suddenly at 52 from failure of the heart; his maternal grandfather at 51 from apoplexy; his maternal grandmother at 56 from "dropsy." His life had been refused by several insurance companies. The patient was a solicitor who took little exercise outside his office, lived freely in eating and drinking and slept mostly over eight hours. The heart was feeble, the face red from congested capillaries (small blood vessels connecting the arteries and the veins). I advised him to take meat but once a day in small quantity; to limit stimulants to a quarter bottle of light claret during the 24 hours and reduce his sleep to 6 hours. In addition he was ordered to take deep breathing exercises every morning during a quarter hour in a well ventilated room, with a hot bath followed by a cold shower and to walk at least two hours a day. There was great improvement in two months, after which the fat elimination of walking exercise was supplemented by a whole day's walking or shooting at least once a week. On this régime A. C. lived in good health, in spite of his very bad family record, up to the age of 74, when he died from influenza. All four of A. C.'s brothers lived on the plan that they must "sustain" themselves by eating and drinking generously and avoid exertion in order to keep from wearing out. They died between 49 and 56 (one from failure of the heart, one from apoplexy, one after an operation for stone and one from a cause unknown to me). Of the five sisters three died from various diseases under 56, one from accident at 45. The fifth, who died at 75, is the subject of Case 5.

Case 5.—A married lady aged 36, consulted me for shortness of breath, dropsy of the legs and varicose veins. The youngest of her four children was 3 years old. Her heart was dilated, she was rather stout, urine normal. She was in the habit of eating rather heartily and taking much water and soup, especially at dinner, with very little exercise. She was ordered to take but a small quantity of meat but once a day; to take little salt, no soup or other fluid at the two principal meals but a

glass of water night and morning. To take regular breathing exercises, gentle ones at first, and two short walks every day in all weathers, and to gradually increase the amount of breathing and walking exercises. Within 4 weeks the dropsy of the legs had disappeared and after another month she was able to walk two hours every day. On this plan her health further improved and remained satisfactory up to the age of 70 when I lost sight of her. I heard afterwards she had died at the age of 75, some months after an accident.

Today in the light of our newer knowledge of vitamins, the above excellent prescriptions would probably be slightly changed by the addition of six glasses of water, a quart of milk, with additional emphasis on the value of the leafy vegetables, like New Zealand and American spinach, beet tops, cabbage cooked but 25 minutes (new 20 minutes), well brushed potatoes roasted, eaten with the skins, celery, onions, etc., while meat would be reduced to the minimum and alcohol eliminated.

McCollum[1] sums up, 1922, the most satisfactory type of diet that will go a long way toward improving the physical fitness of the nation. It is a very simple one and its daily practice involves no great self-denial. It borrows the best elements in those several systems of diet which have been thoroughly tested in human experience. The first and most important principle is the extension of the use of dairy products. Instead of the present consumption of half a pint of milk a day there should be at least a quart per capita. This is the feature of the diet of all pastoral people, past and present, which made them physically superior to all other people. The second principle is that the valuable dietary properties of the leafy vegetables are unique among vegetable foods. These two classes are the "protective foods" for many of

[1] E. V. McCollum, physiological chemist, born 1879. Professor Agricultural Chemistry, University of Wisconsin, 1913-17; professor biochemistry, School of Hygiene and Public Health, Johns Hopkins, since 1917. Cutter lecturer on Hygiene and Preventive Medicine, Harvard, 1917-18; author of numerous papers on nutrition and the relation of diet to growth and disease. Author: "Text Book of Organic Chemistry"; "The Newer Knowledge of Nutrition" (new edition 1922, Macmillan) from which we quote: associate author "The American Home Diet" (1919), also quoted from.

the Asiatic peoples. Their consumption in liberal quantities as regular constituents of the diet serves not only to provide the body with valuable nutrients it cannot secure in adequate amounts from milled cereals, tubers and muscle meats, but also serves to maintain the intestinal tract in a hygienic condition through promoting elimination. Milk likewise serves through its encouragement of the growth of lactic acid-producing organisms (which cause souring of milk) to bring about the disappearance from the intestine of those types of bacteria causing putrefactive decomposition, including substances which are a physiological abomination. This principle, first enunciated by Metchnikoff, is shown by modern bacteriological studies to be sound. Milk has, however, dietary properties which the famous bacteriologist did not discern and which makes it the one food for which there is no effective substitute. It is not only an ideal food when taken over a long period as the sole source of nutriment, but is the best one with which nature has provided us and amply supplements the deficiencies of other foods, such as the cereals, tubers and fleshy roots. It is rich in both calcium and phosphorus, while many vegetable foods are relatively poor in both these elements, especially the former. In fact there are but two classes of foods which are relatively rich in calcium, the principal element in lime and a prominent constituent of bone. These are milk and the leafy vegetables, which two classes have been called the "protective foods."

Spinach is by far the best of these leafy vegetable foods and should be fresh, not canned. It is now on sale practically the year round. In cooking, it should be flavored with a little pork. Those who have gardens can have a very early spring crop by planting the seed in the autumn. In northern states it may require a light covering of straw.

Expectancy of Life Tables

The following table is a combination showing (a) the expectancy of life in years based on the experience of Life Insurance Companies (American Experience Mortality Table); and (b) the expectation derived from the census reports for white males 1909-1911, original registration states.[1] It will be noted that the selected insurance risks have the longer expectancy of life from the age of 26 to 62.

Ages	Insurance	Census	Ages	Insurance	Census
10	48.72	51.32	46	23.81	23.16
12	47.45	49.56	48	22.36	21.77
14	46.16	47.79	50	20.91	20.39
16	44.85	46.04	52	19.49	19.02
18	43.53	44.34	54	18.09	17.68
20	42.20	42.71	56	16.72	16.39
22	40.85	41.13	58	15.39	15.16
24	39.49	39.57	60	14.10	13.98
26	38.12	38.00	62	12.86	12.85
28	36.73	36.43	64	11.67	11.77
30	35.33	34.87	66	10.54	10.75
32	33.92	33.33	68	9.47	9.77
34	32.50	31.82	70	8.48	8.83
36	31.07	30.34	72	7.55	7.95
38	29.62	28.88	74	6.68	7.13
40	28.18	27.43	76	5.88	6.38
42	26.72	25.99	78	5.11	5.71
44	25.27	24.56	80	4.39	5.00

The complete expectation of life at birth is 50.23 years. At the age of 35 it is 31.08 years, which means that the *average* number of years to be lived by those who have attained the age of 35 is 31.08 years. Some will live more than 31 years, some less. This expectation of life increases about six years in the latter part of the first year of life. Of 1,000 living at birth 48 die under 1 month, whereas for the 12th month it is 4.53. The highest expectation is at the age of 2, when it is 56.88 years, and from this apex steadily decreases throughout life. At the age of 12 it is about 50 years, at 43 it is 25 years, at the age of 67 it is 10 years, at 80 it is 5 years and at 97 it is 2 years.[1]

[1] U. S. Life Table, Bureau of the Census, 1921.
[2] U. S. Life Tables at ten year periods from 1890 to 1910. Bureau of the Census, 1921.

Chapter XXXI

EFFECTS OF TOBACCO ON LONGEVITY

Tobacco affects different persons variously. Whether it causes arterio-sclerosis (the increase of connective tissue in the walls of arteries) or not we do see every day that persistent smokers lose too soon their youthful looks and complexion, a change especially conspicuous in women who have fallen into the cigarette habit.[1] There are good observers, among them Prof. Lazarus, of Berlin, who regard excessive smoking as one of the principal causes of arterio-sclerosis, and when we consider the effect of tobacco on the heart in some people, it appears natural that the smaller blood vessels are likewise injured by it.[2] It is ruled out in the training camps of athletes where it is regarded as injuriously affecting the "wind."

When the class of '68 graduated from Dartmouth College, the secretary took a record of those using any alcoholic liquors and of those using tobacco. Fifty years afterward a summary was made of the death rate of the class. The average age at death for those who passed away during the 50 years was 44 years 11 months for those who used liquor in college, and 63 years 6 months for those who did not, a difference of 18 years 7 months in favor of the non-users. During the first 25 years 29.4% of the users of liquor and 6.7% of the non-users had died. The average age at death for those who used tobacco was 49 years 9 months, while for those who did not it was 59 years 4 months, or nearly 10 years in favor of the non-user. Dated Hanover, N. H., December, 1919. Signed by Charles F. Emerson, Secretary, class of 1868.

[1] Sir Clifford Allbutt, noted English scientist.
[2] Sir Hermann Weber, M.D. For biographical note see index.

The above report, believed to be credible, is not reproduced as meeting the requirements of a scientifically conducted investigation. A letter of inquiry developed the following additional facts: The secretary of the class was a man of high character and scholastic attainments. He was a member of the faculty from 1872 to 1899, rising from a tutorship in mathematics to professor of natural philosophy (1878), becoming also instructor in astronomy and, in 1893, dean of the faculty. For 20 years he devoted his entire time to administrative work. Dr. Emerson not only had an intimate knowledge of the individuals of the class of '68 but, we are informed, kept in touch with them. He died since the above information was obtained. The records of their habits as to alcohol and tobacco were entered by each man upon graduation in a class register.

In the Fisk fund prize dissertation on the *Physiological and Pathological Effects of the Use of Tobacco* (physiological, normal, as opposed to pathological, or conditions of disease) won by Hobart Amory Hare, M.D., now a distinguished member of the medical faculty of Jefferson Medical College, Philadelphia, the author devoted 92 printed pages to a study of the effects of tobacco on the normal human body and also on many lower animals (see index for footnote on Hare). The results of his experiments on animals were uniformly to the effect that nicotine in as small an injection as 1/32 of a *drop* caused death in 20 dogs by asphyxiation, death occurring invariably from stoppage of respiration, the heart continuing to pulsate for some minutes after breathing stopped.[1]

Two tables are printed to show the effects on the pulse rate of a man not accustomed to the use of tobacco who smoked one cigarette and on one who was an inveterate user of tobacco. In five days' experimentation with the *non-user* he found that a cigarette smoked before breakfast caused an *average* rise in the pulse from 64 to 96 beats; before dinner, from 66 to 84; before supper from 65 to 92. In the case of the *inveterate user*, before breakfast, from 57 to 74; before dinner from

[1] Fisk Fund Prize Dissertation No. XXIV (Blakiston).

68 to 79; before supper from 67 to 73. For the five days a cigarette was smoked after breakfast caused an average rise in the pulse of the *non-smoker* from 65 to 85; after dinner from 70 to 76; after supper, from 66 to 73. For the *inveterate user* after breakfast, from 60 to 77; after dinner, from 74 to 85; after supper, from 66 to 72. Our author observes the curious fact that although in the case of the *user* of tobacco the eating of a meal increased the normal pulse rate, the increase of rate after smoking remained constant, 17, 11 and 6 beats respectively for breakfast, dinner and supper. Sphygmographic tracings (on a moving ribbon by an instrument part of which rests on the radial artery of the wrist) are printed to show to the eye the variations in the radial pulse before smoking and after.[1]

Instead of quoting Hare's conclusions adverse to the use of tobacco except by men of a phlegmatic temperament who live much in the open air and by old people who have become habituated to its use, we prefer to quote the standard United States Dispensatory, twentieth edition (1918), based on the United States Pharmacopeia and the British Pharmacopeia (1914):

There is no room for doubt that nicotine is present in tobacco smoke in sufficient amount to be injurious. Lehmann [2] finds that about 95 per cent of the nicotine in tobacco passes into the smoke and Toth [3] has shown that a large proportion of nicotine exists in the smoke in uncombined state. The characteristic odor of ordinary tobacco is entirely different from that of fresh (tobacco) leaves, and must be owing to the generation of a new volatile principle. The alkaloid nicotine is a virulent poison. It primarily excites and secondarily paralyzes the ganglia (centers of nerve influence) upon the sympathetic nerves, (controlling the vital action of viscera and blood vessels), stimulates the intestinal muscles and, in sufficient quantities, has a paralytic action upon the

[1] Hobart Amory Hare, professor Therapeutics and Diagnosis, Jefferson Medical College, Philadelphia, since 1891; son of Bishop William Hobart Hare; author of numerous medical works of excellent repute, including "Practical Therapeutics" (fifteen editions, Lea & Febiger).

[2] *Pharmaceutical Journal*, Sept. 18, 1909.

[3] *Chemische Zeitung* (1909).

motor nerves. The most important disturbances produced are in the digestive and circulatory organs. As a result of the disturbed innervation of the heart, palpitation and cardiac (heart) irregularities are common and the vascular contraction (of the arteries) is generally regarded as one of the causes of arterial degeneration. It should always be borne in mind that its active principle is absorbed readily by the skin (and hence probably by the lungs and the various membranes over which smoke passes when inhaled). In its action on the animal system nicotine is one of the most virulent poisons known. Small birds perish at the approach of a tube containing it. The percentage of nicotine in tobacco varies considerably—from 1.62 per cent in Havana tobacco to 2 per cent in Maryland tobacco, 6 in Virginia tobacco and 8 in Kentucky tobacco.[1]

The smoker's cough and its accompanying pharyngitis is usually associated with laryngeal irritation and hyperesthesia (excessive sensitiveness) of the larynx[2] (the organ of the voice). That part of the pharynx here referred to lies adjacent to and behind the larynx.

Huchard, of Paris thought tobacco an important cause of arterio-sclerosis (degeneration and hardening of the arteries) and that it also causes heart enervation (weakness). Kreuznach, of Vienna, has shown recently that nicotine produces arterio-sclerosis.[3] Hurst says nicotine is probably the cause of the relaxing effect produced by moderate smoking and of the tendency to colon spasm when an excessive quantity of tobacco is smoked. Mr. C. H. smoked on an average 4 large cigars, 3 pipes and 6 cigarettes a day. He had colicky abdominal pains and a frequent desire to urinate and defecate. A stricture was found in the rectum and a similar one somewhat higher up. Mr. M., a constant pipe smoker, had abdominal discomfort of fulness in the upper part of the descending colon.

[1] Digested from the U. S. Dispensatory, 1918 (excepting the words in parentheses), the standard authority on the composition, uses and action of medicines, showing later and more authoritative researches than those of Hare.

[2] Green's "Medical Diagnosis.'

[3] "Colon Hygiene."

A frequent phrase used in connection with the use of tobacco is "tobacco heart." Exactly what this is Brooks explains.[1] He noticed years ago that old soldiers, tobacco users, up for reenlistment were frequently rejected for irregular and inadequate heart action. Kept off tobacco for a short time most of them would pass. As a medical officer of a National Guard regiment he had practically the same experience. The record of private patients was very similar. His interest in the cause and prevention of heart disease finally led him to make 54 postmortems where death seemed to bear a relation to the use of tobacco. Of these 17 showed marked hardening of the arteries of the heart (coronary sclerosis) and 19 the same change in a lesser or slight degree. In 37 cases—just one more than presented disease of the heart arteries—there was chronic inflammation of the lining membrane of the heart (endocarditis), which may have been the cause of the diseased arteries.[1]

Observations of many instances of "tobacco heart" by our author caused him to reach the conclusion that in all probability the elemental condition in tobacco heart is one of arterial spasm affecting coronary vessels (arteries of the heart). Similar conditions affecting other arteries, as those of the leg and arm, probably also those of the pancreas, were observed in tobacco poisoning. Complete relief followed the giving up of tobacco. Angina pectoris (breast pang, with a feeling of suffocation, caused by arterial spasm) is a frequent symptom with old tobacco users. It sometimes cannot be relieved by quitting tobacco. Yet there was no definite condition of this kind found in the 36 cases of definite hardening of the heart arteries found in the 54 postmortems, cited above. On the other hand it is important to state that 18 of those cases gave a history of more or less indefinite heart disturbance and 12 cases died a cardiac death (from heart disease). Hirschfelder says the most serious effects are produced in the young from cigarette smoke when inhaled, which, our author thinks, can be explained by the greater sensitiveness of the tissues of the young.[1]

[1] Harlow Brooks, M.D., a New York consultant of large ex-

Brooks distinguishes between true angina and tobacco angina. The former cannot be relieved by the non-use of tobacco while the latter can be. Death may result from acute tobacco poisoning and from tobacco angina but the latter case is probably very rare and most likely only occurs when diseased heart arteries preexist. He recommends moderation in smoking.

perience, visiting physician City Hospital and Montefiore Hospital, New York. Read before the Medical Section of the Buffalo Academy of Medicine, 1915.

Chapter XXXII

WHAT IS THE TRUTH ABOUT ALCOHOL?

As to the effects of *alcohol* as a shortener of life quite a different method was followed by the already cited Medico-Actuarial Mortality Investigation by the forty-three leading life insurance companies than in the investigation already alluded to. The object was to determine the type of lives that are good and those that are bad risks. The companies wanted nothing but facts, carefully checked, regardless of the expense and labor involved.

As to the alcohol habit it was found that among saloon proprietors, whether they attended the bar or not, there was an extra mortality of 70 per cent. The hotel proprietors who attended the bar, either occasionally or regularly, had as high a mortality as the saloon keeper—that is, the life period was reduced about six years on the average. Among those connected with breweries the mortality was found to be about one-third above normal. The large class of proprietors of wholesale liquor houses had an extra mortality of about one-fifth. In the fourteen subdivisions of the trades connected with the manufacture or sale of alcohol there was but one class of normal mortality and that was the distillery proprietors.[1]

Among the insured—and it should be noted that we are dealing with a preferred physical class accepted by the insurance companies, which was not the case with the students cited above—who admitted they had taken alcohol occasionally to excess in the past, but whose habits were considered satisfactory when they were accepted, there were 289 deaths, while there would

[1] Arthur Hunter, Chairman Central Bureau Medico-Actuarial Mortality Investigation, alluded to.

have been 190 had this group been made up of insured lives in general. The extra mortality was, therefore, over 50 per cent which was equivalent to a reduction of over four years on the average life of these men. This does not mean that but four years would be cut off the end of the average life of each man, but that in each year a number of men will die at an earlier age than they should. At 35 the expectation of life is 32 years. If in the first year after that age there should be 12 deaths where normal expectancy is 9, then three men would each lose 32 years of life. In the next year probably four men would each lose 31 years and so on. As a matter of fact many immoderate drinkers would live longer than the 32 years, but not nearly so many as there would be had they been moderate drinkers and far fewer than if they had been total abstainers from alcohol.[1]

With regard to light drinkers daily but not to excess the experiences of the companies were divided into two groups: (a) men who took two glasses of beer or a glass of whiskey or their equivalent a day; (b) men who took more than the foregoing amount, but were considered by the companies to be good risks and not excessive drinkers. The mortality of the second group was found to be fully 50 per cent greater than the first.[2] An analysis of 42,000 insurance risks of "steady, free users" of alcohol was made, under the two interpretations of the meaning of the words "steady free users,"—conservative and liberal. In the first class were placed the risks of those companies which considered that two or more glasses of beer or one glass of whiskey or their equivalents per day constituted a free use. In the liberal interpretation section were placed the risks from those companies which considered that it required the drinking of two ounces of alcohol a day to constitute a "steady, free user." The results:

	Actual Deaths	Expected Deaths	Ratio Actual to Expected Deaths
Conservative	1725	1460.25	118%
Liberal	698	374.43	186%

[1] Hunter.
[2] Medico-Actuarial Investigation, Vol. IV.

These were grouped as follows:

	Ages at Entry	Actual Deaths	Expected Deaths	Ratio of Actual to Expected Deaths
Conservative	15 to 49	1351	1127.92	120%
	50 and older	374	332.33	113
Liberal	15 to 49	612	317.00	193
	50 and older	86	57.43	150

In the liberal section the death rate from cirrhosis of the liver (hardening) was five times the normal and from diabetes, tuberculosis, pneumonia and suicide twice the normal.[1]

Among those whose habits were formerly intemperate but who had reformed for at least two years prior to their acceptance, the extra mortality was fully 30 per cent; that is their average length of life was reduced by about three years, partly due to the weakened power of resistance to disease and partly to relapses into old habits.[1]

Among proprietors, superintendents and managers who attended bar, either occasionally or regularly, there was found a much higher death rate than when members of the same class did not attend bar. For the bartenders the excess over normal ran to 178 per cent; in the second class to an excess of 135 per cent. The proportion of overweights in both these classes was unduly large. For the bartenders the death rate from certain diseases was as follows:

Cirrhosis of the liver, six times the standard (drunkard's liver).

Diabetes three times the standard (sugar in the urine).

Cerebral hemorrhage and apoplexy, nearly twice the standard.

Organic diseases of the heart nearly three times the standard.

Bright's disease nearly three times the standard (kidney disease).

Pneumonia, nearly twice the standard.[2]

[1] Medico-Actuarial Investigation, Vol. IV.
[2] Vol. III.

While no report was made on total abstinence there are sufficient facts published by individual insurance companies to warrant the statement that total abstainers, who have always been so, have a lengthened expectancy of life during the working years of about one-half greater than those who indulge in as much as two glasses of whiskey a day.[1] (Meaning "two fingers" on a whiskey glass.)

While the accuracy of the foregoing figures has not been challenged the conclusions have been by several writers. Arne Fisher, a Dane, asserts that the West Jutlanders (of Denmark) living on the shores of the North Sea, tillers of a barren soil, in a damp raw climate, are the heaviest drinkers of spirits in the world and yet, with New Zealand, have the lowest death rate.

This argument is answered by Arthur Shadwell, M. D., an English authority and contributor to the Encyclopedia Britannica, that where there are so many differing factors as climate, habits of life, occupations, etc., such comparisons as the above are not trustworthy. For instance, France, the largest consumer of alcohol, takes it in form of light, diluted wines. Spirits can be consumed with less danger to health in a damp, northern climate than in a warmer southern one, because in the former case they are more completely oxidized (utilized). When Denmark is compared with her more temperate northern neighbors we get a different result, apparently sustaining the contention of Shadwell. After the age of 44, about the age when alcoholic diseases, like cirrhosis of the liver, may be expected to begin affecting the death rate of a country with a heavy consumption of spirits, both Norway and Sweden make a better showing than Denmark. At deaths for the different ages from 44 to 75, Norway has an average reserve population of 14.44, Sweden 12.91 and Denmark 11.88, (the larger the population the better the showing).

Shadwell also points out the record for 25 years of two English life insurance companies which classify their risks into abstainers and non-abstainers, giving a better rate of 15 per cent to the abstainers, which fact brings

[1] Same.

the latter class under close observation to prevent fraud. Here is the record for 25 years of actual to expected deaths (the smaller the figures the lower the death rate).

	Non-abstainers	Abstainers
Scottish Life Association	79.67	53.05
Scottish Temperance Life Assurance Co.	64	46

Another English company, the United Kingdom Temperance and General Provident Institution, has a mortality for 40 years reckoned at 24 per cent less for abstainers than for non-abstainers.[1]

A very prevalent idea with regard to alcohol is that it is more useful to persons in advanced than in middle age; in fact, that "wine is the milk of old people," that it does for them what milk does for children. This doctrine is not in harmony with careful observation, and alcohol, excepting in great moderation, is even more dangerous to the aged than to younger people. "It seems to me," said Dr. Parkes, "that there must be danger in the use of alcohol when the arteries become rigid in advanced life." [2]

In the "Action of Alcohol on Man," by Starling, the eminent English physiologist, published in October, 1923, the most authoritative book so far in any quarter, his findings are summed up in these words: "Although we have been unable to find any evidence for the view so often expressed that the moderate use of alcoholic beverages is in itself harmful and leads in the long run to deterioration of health and morality, there is no question that its excessive use is the cause of a large amount of disease, crime, misery and inefficiency." He quotes a table by Dr. T. H. C. Stevenson which shows the relative number of deaths from alcoholism and the same combined with liver diseases in a classified list which rises for saloon keepers to the rate of 202 in total deaths of 1265 for all causes—possibly nine times the normal rate. As to the effect of the elaborate studies he has made he says: "I cannot pretend to foretell what will be the effect of the unbiased evidence here pre-

[1] Same.
[2] Sir Hermann Weber, "Longevity."

sented. As regards myself, it has convinced me that in a civilized society the abolition of all alcoholic beverages, even if carried out by universal consent, would be contrary to the permanent interest of the race."

In this same book Dr. Raymond Pearl, of Johns Hopkins, contributes original studies of facts gathered by him at the instance of the National Tuberculosis Association and the Russell Sage Foundation. Cases were selected from among persons registered with the Baltimore City Health Department, the Phipp's Tuberculosis Clinic, and the Johns Hopkins Hospital and dispensary. Eugenic workers were detailed to not only record the facts of the life history of each individual as to tuberculosis but as to alcohol consumption and use of tobacco. These family histories were found to embrace an average of about 250 persons per history. From these records 2,047 persons were selected as fulfilling all the conditions. They were classified as Total Abstainers, Moderate and Occasional Drinkers and *Heavy or Steady Drinkers* for both sexes. In this third or highest class he puts *moderate* drinkers, if they were *steady* drinkers, a classification which the author says he expects will invite criticism (because it commingles heavy and moderate drinkers). He adds: "What we then have in this material is, in effect, a sample of over 2,000 persons, drawn at random from the working classes of Baltimore (but of selected races), each at the age of 20, divided into 3 classes as to drinking habits, and followed by observers throughout life until its termination."

Our author's conclusion printed in italic is that "heavy or steady drinking of alcoholic beverages significantly shortens the average duration of life, but gives no evidence whatever that the moderate and occasional use of such beverages leads to any different duration of life than that associated with complete abstention from alcohol."

As Pearl states in his finding that it is only the "moderate and *occasional*" use of alcoholic beverages that appears to be harmless, while condemning the free use of such beverages, an opinion in which he is strongly supported by Starling, the latter finds it useful to define

"moderate" as used in such connection. On this point he says (digested):

Experiments that have been cited show that 12 cubic centimeters of alcohol (not quite 3¼ teaspoonsful of 60 drops each), when given on an empty stomach, occasionally produce an effect in diminishing power of muscular coordination and other complex nerve processes, but that in nearly all cases the effect of such a dose is unappreciable when taken with a meal. Such a quantity corresponds to a glass of beer or a wine glass of claret, so that our conclusion must be that any alcohol taken on an empty stomach will tend, if only slightly, to depreciate an individual's powers but that a wineglass of claret or a glass of beer taken with the lunch will not interfere with the carrying out of the afternoon's work.

With proper quantitative adjustments this finding corresponds reasonably with those reached by the elaborate investigation of the insurance companies, already cited. On this subject Pearl makes the comment:

"It will be seen that throughout the abstainers enjoyed the greater expectation of life. This is also true of those holding endowment policies. The Medico-Mortality Investigation of 43 insurance companies presented several sorts of data of a somewhat fragmentary character. In general it was found that there was an excess mortality associated with alcohol consumption, but this experience was extremely small."

As to the insurance companies that discriminate between drinkers and non-drinkers he deems their data of little value as not being based on observations throughout the entire adult life-span of each individual.

This conclusion seems to place little or no value on the observation of the directors of insurance companies who, if a mistake is made, must pay heavily for it from the company's earnings. They can point out that in tables quoted with approval in this book, barkeepers, who seldom change their occupations, therefore coming within the Pearl formula, head the list among drinkers of those who die before their time.

Chapter XXXIII

THE REAL FACTS ABOUT GOOD COMPLEXIONS

"No woman can have a good complexion or be physically at her best in attractiveness who is an habitual sufferer from intestinal stasis. Her complexion will not be good, the odors of her body frequently offensive, while her physical and mental reactions will be sluggish. It is strange that the feminine desire to please should not take into account this simple fact so well understood by medical men." [1]

In carefully scrutinizing conditions that make for good complexions, it is pertinent to observe that the toilet-preparations market is in a flourishing condition. The steady expansion of this trade has not been appreciably affected either by hard times or the wide publicity given by the medical and lay press to the poisonous ingredients frequently used, particularly in cosmetics.[2]

The *Journal of the American Medical Association,* probably the leading medical association of the world, having a membership of 80,000 of the reputable physicians of the country, and commanding the confidence of all who are informed, has from time to time published the principal ingredients of various cosmetics offered on the market and the results are generally conceded to be alarming.

The Government has also put out a pamphlet on this subject [3] which says:

"Of the many and varied abuses of drug products there is none in which fraud, deception and a wanton disregard of health and even life are so clearly in evi-

[1] Personal communication from an eminent physician.

[2] Saunders Norvell, representing the drug trade, publishes the fact that there were spent in this country in 1922 $73,000,000 for cosmetics and $145,000,000 for toilet soaps.

[3] No. 305 of the Public Health Reports, Washington, D. C.

dence as in the sale of so called cosmetics. . . . The Iowa Pharmaceutical Association found that out of 66 hair tonics, samples of bay rum, witch-hazel, toilet waters, Florida water and perfumes, 20 contained wood alcohol. . . . The beauty washes and face enamels contain an even more impressive array of dangerously potent drugs, including flake white (lead); diachylon (lead plaster); corrosive sublimate (mercury); calomel (mercury); white precipitate (ammoniated mercury); pearl white (bismuth subnitrate); zinc white, Chinese white (commercialized zinc oxide), and zinc soap. . . . Tuttle found that 3 of 8 face enamels examined by him contained lead, 1 contained mercury, 2 zinc oxide and 2 zinc oxide and calcium carbonate. . . . Many of the so-called beauty lotions are primarily fraudulent. Street, of the Connecticut Agricultural Experiment Station, reports 5 preparations for the removal of wrinkles which were found to consist principally of Epsom salt. Cosmetics as ordinarily used tend to clog the pores of or irritate the skin and are thus likely to interfere with its normal, healthy action" (that is in addition to being actually dangerous, as in the above list, excepting the Epsom salt, which is worthless.

In its pamphlet, already alluded to, the American Medical Association under the title *Cosmetic Nostrums* gives publicity to a long list of toilet preparations, each one of which is supposed to belong to one of three classes: openly fraudulent, dangerous, or worthless.

Under the title *Nostrum and Quackery* the above Association has also published a book on "The Great American Fraud." Its last edition * (1921) contains over 800 octavo pages of closely printed, illustrated matter, much of it new, covering the following titles: Alcohol, Tobacco, and Drug Habit Cures, Consumption Cures, Cosmetics Nostrums, Epilepsy Cures, Female Weakness Cures, Kidney Disease and Diabetes, Medical Institutes, Medical Mail Order Concerns, Men's Specialists, Mineral Waters, Miscellaneous Nostrums, Miscellaneous Specialists, Obesity Cures, Quackery of the Drugless Type, Rheumatism Cures, etc., Tonic Bitters, etc., Miscel-

* Should have a large circulation.

laneous. The closely-printed small type index covers eighteen double column pages of approximately 2,700 items.

This evil trade has been built up on the theory that skin blemishes and other physical defects can be treated by incompetent people as *effects* instead of locating their *causes;* and often that the best way to mend bad complexions is to *cover them up.* This of course is wholly wrong and rests entirely on the commendable desire of those who buy to make themselves as attractive as possible. Through lack of knowledge they go about it in the wrong way. A "made-up" woman, like the man who dyes his whiskers, deceives no one but herself. When the poor imitation is quickly discovered a leaf from her private life is read by the public and her reputation for common sense suffers.

Bad complexions are uniformly due to a specific cause and it is the part of wisdom to discover and remove that cause.

> "Find out the cause of this effect,
> Or rather say, the cause of this defect,
> For this effect defective comes by cause."[1]

In youth, when there is energy in excess of the needs of the body, sins against the organs of digestion and elimination can be committed with impunity by the careless or ignorant and a good complexion still be temporarily maintained. Nature always puts up a good, hard fight against the encroachments of disease. But after a few years the body begins to yield its defenses one by one against intestinal intoxication. After this process has progressed far enough Nature then reverses her first attitude. She is now as hard to coax back to a state of health as she was slow in the first place to yield it. There is no truth in this book that carries weightier consequence to the young than this.

A good *text* for the remainder of this chapter is a remarkably clear marshalling of a few important facts by Hurst, who says the chief defense against intestinal intoxication occurs in the liver, as all substances absorbed from the alimentary canal must pass through

[1] Hamlet, Act III, scene 2.

it before reaching the general circulation and one of its most important functions, when kept in health, is to diminish the toxicity of all sorts of poisons. Other organs, the chief of which is probably the thyroid gland, possess a similar but smaller power of neutralizing and destroying poisons. Even after a considerable quantity of intestinal poisons have reached the blood no great harm need be done, if the excretory organs are efficient. But when the kidneys become diseased these poisons may be a factor in the production of uremia (toxic elements in the blood resulting in headache, shortness of breath, insomnia, delirium, convulsions, coma—profound unconsciousness) especially if increased absorption occurs as a result of colitis (inflamed membrane of the colon), and constipation. When the intestinal delay is in the colon, especially in the cecum and ascending colon, where the contents are fluid and bacteria abundant, an excessive number may reach the blood. Those which escape destruction in the liver and spleen are excreted by the kidneys and pyelitis (inflammation of the pelvis or cup of the kidneys) may result.[1] (See Chapter XXVI), page 191.

As the nutrition of the skin comes from the blood first attention of those who would have a healthy skin must be directed to the source of the skin's nutrition. If a putrefactive or poisonous condition of the colon is permitted the resulting blood will register without fail such a condition in the skin.

A familiar form of bad complexion is acne, a papular eruption with accumulation of secretion of the underlying sebaceous gland. These pimples are really minute abscesses, involving the sebaceous or fat glands of the skin. The cause of every acne, says Pusey, is the formation of blackheads (comedos). These blackheads are masses of semi-solidified fat and capped by a blackened mass of dirt and debris of the skin which have clogged up the glands. Very often blackheads may be abundant without the presence of many pimples; at other times the acne eruption will obscure the blackheads. They are generally located wherever the fat

[1] "Constipation."

glands are most numerous and largest—on the face, back of the neck, upper part of the back and chest. They are most frequently confined to the face and often persist after 30. They are most numerous during adolescence (the later years of youth, up to the age of about 25) because the fat glands and hair follicles at puberty take on a new activity. The coarser the skin the more common the affliction.[1]

The treatment in obstinate cases taxes all the skill of the physician. The condition of the general health becomes a factor. Most frequently we see digestive disturbances and anemia (deficiency in red blood cells) associated with acne. In treatment, if the skin is thin and relatively dry, the face should be thoroughly washed with a good toilet soap and warm water, care being taken not to leave the skin unduly dry or chapped. In a greasy, thick skin there is little danger of doing too thorough a job with a rough wash cloth kept scrupulously clean. Application of alcohol will still further continue the cleansing process. The object is to not only remove the dirt but all infectious material and micro-organisms and get rid of some of the horny skin obstruction to a free opening of the sebaceous glands. If a moderate effect is needed a bland soap should be used; if the case is a bad one a stronger soap. If the abscesses are superficial, showing a yellow point, they should be wiped with alcohol or peroxide of hydrogen and opened with a needle which must also be dipped in alcohol or tincture of iodine each time it is used. Finally the whole face should be wiped with alcohol or peroxide of hydrogen. Deep-seated acne abscesses without a pus point cannot well be opened by the patient. Steaming the face as a preliminary step to removing the blackheads is a valuable measure. If the mass does not come out with moderate pressure or with the use of the circular opening of a small key pressed around it, postpone the attempt for a day or two.[1]

Pusey's view of the cause of acne is not shared by

[1] "Care of the Skin," by Wm. Allen Pusey, A.M., M.D., professor of Dermatology, University of Illinois. Third edition (1917), Appleton.

a majority of the most eminent investigators. Among those who believe that a bacillus is the cause are Engman, Hodara, Gilchrist (of Johns Hopkins), Fleming, Western, Molesworth, Lovejoy, Hastings, Hartwell, Streeter, Sudmerson, Thompson, Morris and Dove. Of the above Engman has been working on the problem since 1893 when he was an associate of Unna, of Hamburg, Germany, and has continued on it since emigratting to this country.

Kellogg makes short shrift of the subject by saying that the principal cause of some twenty skin affections and deranged skin functions is to be found in intestinal poisons. Among the former he mentions wrinkles; thin, inelastic, starchy skin; yellow brown, slate-black, blue skin, including so-called liver blotches; muddy complexions; offensive secretions in the region of the flexures (see diagram of the colon); irritability of the skin; sweating of palms and soles of feet; eruptions, including sores and boils; acne rosacea (red nose and cheeks); deranged sweat glands including dandruff (seborrhea) leading to baldness; dry tetter (psoriasis;) reddish papules accompanied by intense itching (lichen planus); jaundice; cold and clammy extremities; pinkish discolorations with yellowish centers on the thighs and trunk (pityriasis); red patches with grayish or yellowish scales (lupus); eczema; vegetable parasitic scale patches (herpes circinatus); localized itching (pruritus); blebs, watery pustules (pemphigus[1]). Lane, as we have seen elsewhere, says the armpits, abdomen, adjacent aspects of the thighs and the covering process of the spine become darker and darker. (Chapter XIII).

Soap.—Normally in soaps there is not a complete union of the caustic potash or soda (the alkalis) with the fatty acid and a certain amount of free alkali remains in the soap. If there is much free alkali, the soap is irritating to the skin. In good toilet soap the free alkali should not exceed one-fourth of one per cent. Floating soaps are made by incorporating air while the soap is being manufactured. The natural color of the best quality of toilet soap is creamy white, but

[1] "Colon Hygiene."

whiteness in itself is no sign of superiority. Medicated soaps are of little or no value. Medicated soaps, cheap soaps and freak soaps should be avoided. The more extravagant the claims for extra virtues made for a soap the more skeptical the buyer should be. Resin is an undesirable element and if present can sometimes be detected by its odor or stickiness. The manufacturer should be chosen who has a long-established reputation to preserve rather than select a soap on account of its high price.[1]

Face Powders. Used with discretion are an agreeable adjunct to the toilet. Three good formulas are the following: (1) Boric acid, 1 part, talcum 9 parts. (2) Boric acid 2 parts, starch 8 parts. (3) Boric acid 1 part, starch 4 parts, talcum 5 parts. Perfumed to suit.[1]

Ointments and Creams have no value as so-called skin food. Their only value is to soften a dry skin. The occasional anointing of the face (even the naturally oily face) with a bland fat, like olive oil, cold cream, rose ointment or vaseline (which has the advantage of not becoming rancid) and its immediate removal by rubbing, is an excellent measure for thoroughly cleansing the skin and can be profitably indulged in occasionally with benefit to the appearance and preservation of the complexion. All excess should be wiped off. If the skin is naturally oily the wiping should be followed by a good washing with soap and water. Cold cream varies greatly in quality. Here as in soaps choose the name of a responsible producer.

In place of fats for cleansing and softening the skin there are fat-free creams or lotions which are less well known, but which furnish excellent substitutes. A good one is as follows:

Gum tragacanth	80 grains
Glycerine	½ ounce
Boric acid	½ ounce
Oil of bergamot	5 drops
Oil of rose	1 drop
Oil of lavender	2 drops
Water to make	1 pint[1]

[1] Pusey.

A good glycerine soap is an excellent toilet article. It is bland and the glycerine has a softening effect. Ivory guest soap is approved

This is a type of the hand lotion used in hospitals. There is no objection to its daily use. It cleanses and softens the skin, is not greasy and can be wiped off easily, with a soft towel. Its use, however, should not take the place of soap and water.[1]

The presence of pus should be treated with vigorous washing with soap and water to wash out the infective organisms and prevent the smearing of them over the face. A good solution in presence of pus (pimples, acne, etc.) is hydrogen peroxide or alcohol. They are the two best antiseptics (germ destroyers) for use on the skin. Along with these a good wash is a saturated solution of boric acid in water (as much boric acid as the water will absorb). Boric acid finely powdered is also the best antiseptic powder for general use. If 10 per cent boric acid is added to vaseline the product is an excellent antiseptic ointment. Tincture of iodine is an efficient antiseptic.[1] If it has become thickened by evaporation care should be taken to restore the alcohol.

Of *wrinkles* Bennett says muscles increase in size, strength and elasticity when properly exercised. In youth these muscles support the tissue and skin overlying them, but as years advance if they are not exercised like any other muscles they will shrink. Then the skin, not being properly supported, falls into those creases we call wrinkles. For these deep wrinkles, sagging skin and sunken cheeks there can be but one cure—to increase the size of the supporting muscles and the circulation of the blood in the skin and connecting tissue. This is done by thoroughly massaging the neck with the palm of the hand from the center under the jaw towards the left ear and simultaneously towards the right ear until the skin becomes red and warm. This massaging is then transferred to the side of the face, commencing at the point of the chin and applying the friction with the palm upward over the cheek past the lower point of the eye and on over the ear. Follow by massage of the skin of the forehead by upward friction and the surrounding tissue and muscles of the eyes by gentler circular motion (not the eyeball).[2]

[1] Pusey.

[2] Digested from Sandford Bennett's "Old Age," a wordy but sug-

A pair of deep wrinkles frequently run from each side of the nose down to a point near the ends of the lips. If the fingers are placed on each cheek bone and moved towards the top of the ear these wrinkles disappear. The proper massage to permanently eradicate them is to lay the index and second fingers close on each side of the nose and move them with considerable friction in a curved line towards the top of each ear, thus exactly reversing the downward sag. The fundamental idea under all these face and neck exercises is muscle and circulation development.

A second exercise for the neck muscles should follow. Lying prone on the side move the head as far back as possible, thus thoroughly stretching the muscles of the front of the neck but not to the point of fatigue. Then bring the head forward until the chin if possible is touching the chest. This will exercise all the muscles of the neck. Commencing with ten movements each morning they can be increased as the strength warrants to fifty. An additional exercise that is very valuable is to lie on the back with both hands in contact under the head. Raise the head against the resistance of the neck muscles and put the head back into position against the resistance of the arm muscles. Commence with not more than five movements and gradually and slowly increase to twenty-five.[1]

To also develop the upper chest, back and neck muscles see exercise 7, page 189.

A valuable adjunct and preliminary to face massage is to apply a cloth wrung out of hot water to the skin for a minute or two and follow it with a cloth wrung out of water at a temperature of about 50° or 55°. The tonic effect to the skin is an important result.

The skin should be washed with warm water and a bland soap,[2] followed by cold water for its reaction, and

gestive book full of "before and after" photographs. Instead of the above it is better to have the damp hands covered with a bath towel or coarse mitten as the naked hands do not develop enough friction. The treatment is reported to be gratifyingly effective, noticeably within 6 months. It is supplementary of No. 7 of the abdominal exercises in Chapter 26.

[1] Bennett.

[2] Pusey.

that followed by a brisk rub with a coarse bath towel or a gentler rub with a skin brush.[1] The face should now show a good circulation, the skin tingling and the pores open for the discharge of the natural oil needed for a healthy skin texture. At night a good cold cream or fat-free lotion can be rubbed in and thoroughly wiped off with a soft cloth, leaving the skin clean.[2]

The sallow skin is easily accounted for by the student who digests the facts presented in this book. It is in practically all cases, where disease is not present, caused *by a long offending* in unhygienic practices within the digestive tract. If it has a special cause, like jaundice, this disease is also caused by the deterioration of one of the great digestive organs, the liver.

Blood drawn from the abdomen of a fasting animal *before* entering the liver and also *after* it has gone through the liver shows that the blood before entering the liver is sugar free but upon emerging from the liver always contains sugar. As there is no duct for such transfer of liver sugar to the blood it has been found to soak through the thin walls of the blood vessels into the blood current.[3] The liver stores sugar in the form of glycogen. Any disturbance of this sugar storage process in the liver leads to the presence of sugar in the urine. These disturbances may extend from the mere presence of sugar in the urine after a hearty meal when the absorbing power of the liver cannot keep pace with the sugar eating up to the dread disease diabetes.[4]

Roger from a series of experiments reported that large doses of candy weaken the protective power of the liver and are the cause of so-called biliousness in many people.[5]

[1] That can be softened if necessary by being dipped in water.
[2] Pusey.
[3] W. W. Keen, Emeritus Professor of Surgery, Jefferson Medical College, Philadelphia, in *I Believe in God and Evolution*, Lippincott's (1922).
[4] "Manual of Dietetics," Wm. Wood & Co., by J. Milner Fothergill. Late physician to the City Hospital for Diseases of the Chest, London.
[5] "New Dietetics."

Chapter XXXIV

PROMINENT AUTHORITIES ON LOSS OF HAIR

The greatest predisposing cause in premature loss of hair is heredity. In 1200 private cases a family history of baldness was found in 571. Of these cases 28 were brokers, 81 clerks, 38 lawyers, 35 merchants, 74 physicians, 68 students, 57 teachers and 34 of other professions and trades, all indoor occupations. The exciting cause is frequently some form of inflammation of the scalp characterized by excessive oily secretion which collects on the skin in the form of an oily coating, crusts or scales. Of the 1200 cases 730 were due to this cause; either the dry and flaky form (dandruff) or the crusted form, either with or without inflammatory symptoms. In women dandruff, both dry and oily variety, were more often seen than in men. While men often become pronouncedly more bald than women, the latter more often suffer from moderate loss of hair. There were 410 males and 790 females in the above total. In men when the hair begins to fall it is usually progressive, while in women the hair falls for a time and grows in again. The disease is contagious and very prevalent. The wonder is not that so many people lose their hair but that more do not.[1]

The prognosis (forecast) is good if taken in time before there has been actual thinning of the hair and there is no family history of baldness. Even where there has been decided loss of hair there is a fair prospect of

[1] "Diseases of the Hair," by George Thomas Jackson, M.D., professor of Dermatology (diseases of the skin), College of Physicians and Surgeons, Medical Department, Columbia University, and Charles Wood McMurtry, M.D., instructor in Dermatology, same. Lea and Febiger, Philadelphia (1912).

staying the course of the disease and increasing the diameter and amount of the hair if treatment is persisted in. Hair is of slow growth and six months will be needed to show progress. In women the prognosis is much better. When the scalp is atrophied (shrunken) and bound down to the skull the prognosis is bad.[1]

Where there is no local disease to combat, the first step is to *increase the circulation* by massage of the scalp, to loosen it up, followed by a stiff brush used carefully. This should be done frequently. Before commencing, for a man, hot cloths are sometimes advantageously applied; and there should be some emollient (a substance to soften and soothe the skin), and there is nothing better than *sulphur cream*, which our author has used for many years. Its formula is:

Ceræ albæ (white wax)	7 drams
Ol. petrolati (liquefied vaseline)	5 ounces
Aquæ rosæ (rose water)	2½ ounces
Sodæ biborat (borax)	36 grams
Precipitated sulphur	7 drams[2]

The patient is to rub a little of this into the scalp (not the hair) for three nights in succession. It is better if the application is made by another person. On the fourth day the scalp is to be washed with tar soap and water. After drying the ointment is to be reapplied. For the next seven to ten days it is to be used every other day and the scalp again washed with good tar soap. Then the application is to be made three times a week, the washing to come at the end of two weeks. The number of applications is thus to be reduced until the ointment is used twice a week and the washings made every two or three weeks. Now in the intervals the pilocarpine lotion is used morning and night.[2]

R. Sabourand,[3] quoted by Jackson, endorses the use of pilocarpine (from the leaves of the pilocarpus), especially in the loss of hair in women. His formula is:

[1] Jackson.

[2] Or a good article of cold cream to which is added 10 per cent of precipitated sulphur, worked up in a mortar.

[3] A French dermatologist of distinction.

Grain alcohol	8 ounces
Spirit of lavender	6½ drams
Spirit of ether	6½ drams
Pilocarpine muriat (alkaloid from leaves of pilocarpus)	6 grains
Water	sufficient to dissolve
Liquor ammoniæ (ammonia water)	1 dram

Jackson has used this formula with satisfaction, especially when the hair is oily.

The four medicinal agents that are of most use in this disorder are sulphur, resorcin, tar and mercury, and the greatest of these is *sulphur*. The chief objection to its use is that nothing dissolves it excepting in a very small percentage, so it must be used in ointments. The addition of 2 or 3 per cent of salicylic acid to the ounce in certain cases makes it more active. Sulphur need never be used stronger than a dram to the ounce (1 part to 8). When it cannot be used because it sets up inflammation resorcin may be substituted, 1 dram to 4 ounces of absolute alcohol (alcohol deprived of its water), with 20 drops of castor oil. It is usual to add a small percentage of bichloride of mercury (corrosive sublimate) to the resorcin for its antiseptic effect (the destruction of germs) and the chloral hydrate is sometimes added for its stimulating effect. Thus we have a substitute for the preferable sulphur prescription:

Alcohol	4 ounces
Hydrarg. bichlorid (mercury)	1 to 2 grains
Resorcin	1 dram
Chloral hydrat.	1 dram
Oil ricini (castor oil)	20 to 30 drops

The alcohol insures rapid drying.[1]

In the use of sulphur cream care should be taken not to daub the hair. It can best be applied to the scalp by the use of a collapsible tube which forces out a thin stream through an extended conical opening at the exact point to be treated and in the small quantity desired. Using the stiff brush as a treatment supplementary to massage not only effects the reddening of the scalp without injury, if care is used, but it removes dead

[1] Jackson.

hairs so that live ones can come in. Our author also recommends light headgear, and frequent exposure to the air and sun.

The loss of human hair is a natural process. As soon as the old hair falls out there is a growth of new hair, if the scalp is kept in a condition of health. According to Unna (a distinguished German dermatologist), the cause of the loosening and shedding of the hair is to be sought in the *character of the blood supply*. Any lessening of the nutritive supply to the papilla (bottom of the hair follicle or sac from which the hair springs) causes the hair to be shoved higher up so long as it remains in the middle third of the follicle, but when it reaches the unproductive upper part of the follicle, that is, just below the mouth of the sebaceous gland, the circulation fails, the hair ceases to grow and falls out.

The new hair pushes up in the old follicle and grows sometimes alongside the old hair and sometimes pushes it out. The length of life of the hair varies with the individual. Mahly has determined the length of life of the eyelashes at 135 days. Pincus says the human hair has a life of from two to six years. Shaving and cutting the hair makes it coarser and may stimulate its growth. Wilson, an English authority, says the average number of hairs, on the scalp is 1,000 to the square inch.[2]

If the hair is dry a strongly alkaline ordinary soap should not be used. In that event a good soap, recommended by Paschkis[1] is compounded of good castile soap 80 parts; bicarbonate of soda (cooking soda) 20 parts; water 100 parts. A very little of this makes an abundant lather. If the scalp is very tender use borax and water (harmless in any strength).[2]

[1] Of the University of Vienna. This can be made by cutting or shaving down 8 ounces of soap which can be put in a pan with 10 ounces of water and 2 ounces of soda. Just bring to a boil and stir until the soap is dissolved. Pour into a jar and let stand for 2 or 3 days. This will give a jelly soft soap at very small cost. Or the proportions can be reduced to 4 of soap, 5 of water and 1 of soda. Not suitable for washing woolens. This is a good way to use up bits of left-over soap.—Scientific American Cyclopedia of Formulas.

[2] Jackson.

A stiff brush should be used systematically in the morning with considerable vigor so as to produce a feeling of warmth but not soreness. *Oil will thus be restored to dry hair.* The brush should be kept in a clean condition by the use of soap and a strong solution of borax and laid in the sun to dry resting on the bristles. Afterwards it can be turned up.[1]

A millionaire coal operator told the writer that he had never learned how to cure baldness but that he had the satisfaction of having learned years ago how to stop his hair from coming out—by vigorous massage of the scalp followed by an application of a stiff brush, the stiffest he could find—which he used carefully but persistently. This is an excellent recipe.

It has been found by sailors in the arctic region when on a voyage of three years or longer that thin hair as a rule is greatly strengthened and frequently restored by exposure to the cold air.[2] When nature needs the hair she provides it if there is no permanent baldness. The reverse of this is believed by numerous authorities to be also true, that people can greatly accelerate the loss of their hair by too much head covering, by living in superheated houses or offices (above a temperature of about 68°) and by neglecting the rules of health hygiene, especially of the intestinal tract, as set out elsewhere.

The Bath and the Skin

An important organ, by which the general health, the elimination of toxic substances and the duration of life is powerfully influenced is the skin. It is the chief regulator of the body heat; it has a great share in the excretory functions and reflects impressions on the nervous system from without. In old age the skin becomes drier and less elastic and many of the capillaries (the minute blood vessels of the skin, as here used) become obliterated. All active exercises help in keeping up the circulation of the skin and in preserving its functions but one of the most powerful means is the *bath.* Many persons with an active circulation can use cold baths

[1] Jackson.
[2] Donald MacMillan, Arctic explorer (personal statement).

from early life to very old age. Others with poor reaction (reddening of the skin after a cold bath), especially weakly rheumatic subjects, do better with a hot bath. Others do best to begin with a hot bath and then to turn on the cold tap and sluice themselves, head included, thoroughly with cold water, or finish most advantageously with a cold shower. The same effect can be attained by applying the water by hand. In this way the chill of the cold water is eliminated in a most agreeable reaction. By exposing the skin and its blood vessels to an alternation of heat and cold, the different components of the skin are nourished by increased circulation, stimulated and enabled to resist chills by sudden change of temperature. The hot bath has, in addition to its local effects an immediate influence on the distribution of blood through the body. The heat of the water attracts the blood to the skin and diminishes the amount in internal organs. It ought not therefore be taken soon after a principal meal when the stomach requires a large amount of blood. After the cold application the skin should be vigorously massaged with a rough towel, including the face and neck. Thus the bath, whether cold, or first warm and then cold, acts as a kind of gymnastic exercise not only for the skin but for the muscles, preserving the elasticity of the blood vessels of the skin, strengthening the heart, relieving the kidneys and assisting in maintaining the energy of the nervous system. With the ordinary bath we can well combine a short *air bath* by keeping the body uncovered for five or ten minutes or more after the drying and rubbing process is finished while the skin is in a state of glow. This increases the tonic influence of the bath and should be combined with gymnastic exercises, not neglecting those of the abdomen. The air bath alone during some minutes to a half hour and longer, if used with judgment, of which the test is a feeling of exhilaration, counteracts the liability to colds and rheumatism, exercises a beneficial influence on the nervous system and food assimilation and promotes intestinal activity.[1]

Very commonly in the course of a fever the patient is

[1] Sir Hermann Weber, M.D., "Longevity."

restless, uncomfortable and sleepless and yet does not have a high temperature. Such a case may be sponged off with tepid water or with a little alcohol and water, or salt and whiskey, with great benefit in the production of sleep, and the reduction of fever. Sometimes the sponging is successful when used only over the arms and legs, but more frequently it should be extended at least to the spinal column. If tepid water does not lower the fever, then ordinary cool tap water should be used. It is well to remember that the secret of successful sponging lies in the use of a sponge not saturated with water but only sufficiently wet to leave a thin film of moisture on the skin, which cools the patient by its rapid evaporation and does not wet the clothes or the bed.[1]

[1] Weber.

Chapter XXXV

A BAD COLON AND BAD TEETH

Pyorrhea (Riggs disease, tooth infection) is one medical term that seems to have been thoroughly mastered by the general public. This is another way of saying that this disease has a wide distribution.

First as to causes. Brackett[1] says one fact is absolutely sure of this disease, when it once becomes deeply established it can never cure itself or come to an end spontaneously with any result short of loss of the teeth. Another is that any treatment the dentist institutes will bring no real success unless the treatment includes the thorough removal of all concretions (hard deposits) from the surfaces of the teeth and especially and emphatically from those surfaces beneath the gums. Attention should also be directed to the fluids of the mouth that they may be slightly alkaline or at least neutral. If slightly alkaline the food is better prepared for stomach digestion. Another advantage of great practical consequence is that this alkalinity (tested by litmus paper which is turned blue by alkalis, the stronger the alkali the deeper the blue while acids turn the color of blue litmus paper to red) gives protection to the teeth from the acids to which they are frequently exposed such as the acids of condiments (spices, sauces, pickles, relishes and of many fruits). Whenever the teeth are "set on edge" the explanation lies in superficial corrosion and irritation by the acid.[1]

The dentist often sees, particularly in the case of young girls who are overworking or indulging too much

[1] Charles A. Brackett, D.M.D., professor of Dental Pathology, Harvard University, ex-president National Dental Association; author of "Care of the Teeth" in *Harvard Health Talk.* Harvard University Press (1915).

in late hours and unwise diet, mouths that show unmistakably the presence of acidity. Associated therewith are almost always found the ravages of extensive decay, extreme sensitiveness and an entire absence of calcareous deposits (limestone like), or tartar (consisting of mineral and organic matter). The general health needs attention first in such cases and adoption of the proper regimen to neutralize the acid condition. More rarely there may be such extreme alkalinity and such a superabundance of lime salts held in suspension that there becomes attached to the teeth great quantities of calcic (lime) concretions which are hard to detach. These do not cause decay but their influence is in the direction of Riggs disease.[1]

In antagonizing mouth acid we have four principal agents. The first is prepared chalk, which chemically neutralizes acid; a second is the bicarbonate of soda (cooking soda). As much as can be held on a dime in a small glass of warm water (half a drinking glass) and used in rinsing the mouth is a good temporary method. A third is lime water. As lime is soluble in water only to a very slight degree its affinity for water may first be satisfied by slaking it. Put the slaked lime mixture in a bottle and fill with water. This may be diluted somewhat with plain water.* It may be also used as an addition to milk to avoid curds in the stomach and neutralize excessive gastric acidity. A fourth and most effective agency for neutralizing mouth acids is milk of magnesia. It should be smeared over the teeth and left there. As teeth ordinarily decay more at night than during the day this use of magnesia at night is peculiarly helpful.[1]

There is a way of practicing dentistry which has been proved capable of preventing a large part of the ills of teeth. As sometimes pursued this method gives the dentist an annual fee so that the teeth are given a

[1] Brackett.

* Lime water can be made by adding a piece of unslaked lime as large as a walnut to 2 quarts of boiled water in an earthen jar. After stirring thoroughly allow to settle. Pour off the clear liquid into a well-stoppered bottle. More water may then be added to the lime until the latter is all used.—Hare's "Therapeutics." It is alkaline and astringent, useful externally as an application to ulcers—hence its value as a mouth wash in pyorrhea.

thorough cleansing and scrubbing once a month regularly. This process commenced with children and persistently followed up results in the prevention of a very large percentage of decay cavities of the second class. If the dentist has the opportunity of using the stick and fine pumice stone on all the tooth surfaces of a child there is developed greatly increased hardness and capacity of resistance, just as callosity of the palms results from hard use. Pyorrheal conditions would thus be altogether prevented and sets of beautiful, sound teeth developed.[1]

In this connection one or two additional suggestions are pertinent. Sugar when properly eaten by a child after a meal is not harmful. The mischief from sweets comes from their power to create fermentation. They may be taken in such quantities as to impair digestion and lead to a decided acidity which, if not directly developed in the mouth, is conveyed from the stomach to the marked disadvantage of the teeth. The second is that nursing mothers are fraught with a peculiar danger to the teeth. A popular idea is that "every child costs the mother a tooth." This is partly explained by the extra demand on the mother's vitality in the nourishment of the new being during pregnancy; but probably the greater source of danger lies in the derangement of the mother's digestive system as manifest in the morning sickness.[1]

We are indebted to Osborne for a thoughtful paper on this subject. It is based on the four suggestions: (1) Open infections in the mouth should be treated and eradicated. (2) The same for root infections. (3) Ill-fitting crowns and non-removable bridges are generally odoriferous abominations. (4) The dangerous mouth germs are those found in inflammation of the heart, focal pneumonia, lobar pneumonia and conditions induced by syphilis.[2]

Early pyorrhea can be treated so as to save the teeth and preserve the health. Such temporizing treatment as is often resorted to does no more than keep the deeper infection concealed. More efficient methods are necessary.

[1] Brackett.
[2] Oliver T. Osborne, M.D., professor of Therapeutics, Yale Medical School.

If putridity is concealed in a closed pocket, as under crowns and bridges, will anyone assert that the absorption of the putrefactive poisons present is not dangerous? All dentists know the odor present when some of these gold attachments are removed.[1]

Unfortunately some forms of infection cannot be disclosed by X-ray films. Also many X-ray pictures are imperfect or misread and many teeth are extracted unnecessarily. These films should be examined by experts and also by the patients' physician. If the patient is seriously ill, then extraction is often the safer course. Everyone knows of one or more deaths from tooth infection. One of the most frequent and the most serious systemic disturbances caused by mouth infection is disease of the heart. The next most frequent is disturbance of the endocrine glands and the symptoms from such disturbance are manifold.[2]

Rosenau [3] says children need about five times as much calcium (food-lime) in their diet as adults. The first permanent molars (6 year molars) are perhaps the most important teeth in the mouth and are the most frequently neglected, partly because they are often mistaken for temporary teeth. Decay is favored by the fermentation of starchy foods and sugars, so that all food particles should be removed after each meal by the use of silk floss.* Children should be discouraged from eating crackers and candy between meals.

The noses and throats of all children require examination for adenoids, polypi, deviation of the septum

[1] Osborne.

[2] Endocrinology refers to glands that produce internal secretions. They influence heredity, morphology (form and structure), metabolism (the sum of chemical changes in nutrition), immunity, development, function and nutrition; and its application to any field of medicine must logically relate to one or more of these categories—"Endocrinology and Metabolism" (Appleton's, 1122).

[3] "Preventive Medicine and Hygiene" by Milton J. Rosenau, professor of Preventive Medicine and Hygiene, Harvard; director of the School of Public Health of Harvard University and Massachusetts Institute of Technology (Appleton, 1922).

* It should be supplemented by thorough and frequent rinsing of the teeth at every opportunity. The floss frequently after use has a very positive odor—a sufficient indication for its use.

(partition), etc., and all inflammations of tonsils, throat and nose treated promptly. Nose-bleeds and mouth-breathing during sleep should be reported. In all cases of acute illness the throat and mouth should be examined for indications of scarlet fever, measles and signs of tonsillitis or diphtheria and a culture taken promptly of any suspected case of diphtheria. Those with large tonsils, recurring tonsillitis and enlargement of the neck glands should be examined by a competent physician.[1]

Simple inflammation of the gums in the majority of instances, says Goadby, results from a too-vigorous use of a stiff tooth brush. The gum injuries are generally most marked on the left upper jaw in right-handed people and the right lower jaw in left-handed people. The gum edge is generally thin and transparent next the teeth but thickened and irregular nearby. These injuries are seldom found on the internal surface of the gums. Their prevention lies in the use of a small tooth brush with a circular motion, which allows the interstices or crevices of the tooth surface to be cleaned, in addition to polishing the labial (lip) portions. Anything in the nature of gritty dentifrices should be avoided. By far the best method of cleaning the gums in any form of inflammation is a swab of cotton wound around the finger, by which the surfaces are gently mopped and pressed, care being taken to avoid any rubbing motion. The movement should be upward in the lower jaw and downward in the upper. This use of the finger is common to many races including a majority of Hindus of all classes (in India).[2]

The mildest inflammation of the gums affects the gum margins. It is usually but not invariably associated with general cold in the head and catarrhal condition of the mucous membrane of the upper air passages. The gums are generally sore to touch, even with food, although there is little to be seen; the teeth feel elongated and loose.

[1] Rosenau.

[2] Sir Kenneth Goadby, lecturer on Bacteriology of the Mouth, University College Hospital, London; late bacterial specialist Royal Herbert Hospital, Woolwich; Erasmus Wilson Lecturer, Royal College of Surgeons. Author of "Diseases of the Gums" and "Oral (mouth) Mucous Membrane" (Oxford Medical Publications, London, 1923).

The gums may be so congested (accumulation of blood to the part) that pulsation is complained of. Cold sore of the lips is more common to persons with catarrhal gum trouble. The tooth feels long because of engorgement of the vessels of the tooth socket, which forces the tooth slightly upward. In simple cases there is no pus. The affection as a rule passes off as the symptoms of the throat and nasal mucous membrane subside, but shedding of the gum and mucous membrane occurs. Mild acid lotions are usually the best treatment. If inflammation of the tough fibrous membrane surrounding bone tissue ensues local ionization is recommended (decomposition of a chemical compound used medicinally by electricity).[1]

This catarrhal affection, although slight, has considerable bearing on other affections of the gums, more especially predisposing to infection which may develop into pyorrhea, the catarrhal condition causing slight swelling of the gum margins, leading to occasional small ulcerative patches. There is little doubt that chronic congestion and inflammation of the gums, leading to final loss of many or all the teeth, is increasing in civilized communities.[1]

Chronic inflammation of the gums and stomatitis (inflammation of the mouth) characterized by bright red gums, commences insiduously with bleeding. There is no pus but general swelling and irregular attacks of ulceration of the gums alone or of the whole mouth may occur sporadically (separately or apart). The disease does not heal of itself. In early stages diarrhea and gastro-intestinal symptoms are common. The best local application is borax and glycerine painted on the ulcerated surfaces.* Fresh fruit juices and other anti-scorbutics (relating to scurvy) should be used. As to vitamin efficiency information is not yet forthcoming.[1]

Chronic infection and irritation around crowns, badly fitting dentures (false teeth) and their clasps, ill-designed

[1] Goadby.

* Pour some boric acid into a bottle, set in warm water, to about one-fourth its capacity. Add glycerine until the point of saturation is reached. If any free crystals are left in the bottle it will make no difference. It is antiseptic but a weak germicide (germ killer).

bridges, projecting edges of fillings and other forms of dental irritation are often associated with localized enlargement of the gum tissue.[1] The discovery of infected bony tissue in relation to the margins of caps and crowns is such a common routine observation that it may be almost regarded as a foregone conclusion, especially when a cap crown has been fixed upon a tooth for any length of time, and when the pernicious habit of driving the edges of the crown under the margin of the gums is adopted, a method which can only be described as criminal, signs of alveolar infection (of the bony socket), or thickening of the border of the socket, being practically constant. Many fillings, particularly between teeth, are apt to show tooth decay. Very often a third tooth root is thus exposed. It is not always possible to determine the depth of a "pocket" from an x-ray film.[1]

Wasting of the gum tissue, leaving the necks of the teeth exposed, is brought about by wasting of the gum as a whole. The diagnosis is not always easy. The absence of pus, congestion and bleeding distinguishes the affection from pyorrhea.[1]

In true aveolar abscess the teeth become destroyed by the action of bacteria on fermentable foodstuffs left between the teeth, which fermentation results in acids, mainly lactic, which attack the lime salt which composes 90 per cent of the enamel.[1]

As to treatment, not a few acute dental abscesses discharge and clear up. Therefore an attempt should be made of clearing and sterilizing the tooth root in bad cases by incision and drainage. It may be taken as a

[1] Goadby.

NOTE TO SECOND EDITION.

The well-founded fear in removing infected teeth of intensification of symptoms is based on error. Any such increase is proof of the highest order that the method was probably faulty. A dead tooth may do no apparent harm for years and then for obscure reasons become a point of infection. Sound judgment must be exercised in extracting such teeth. Removal of tonsils without elimination of dental infection is irrational. Almost without exception these teeth are regarded as harmless. We are beginning to find out that this pulpless, X-ray, negative tooth may be a worse offender than one that shows rarefaction (expansion, lighter in substance). Recent discovery of symptomless abscess in toothless jaws containing streptococci (see footnote p. 284)

general principle that no tooth should be sacrificed because of abscess from infection of the gums, but abscesses arising from tooth pulps (the soft, vascular tissue occupying the central cavity), and which have produced inflammatory changes around the tooth apex (top of the root arch) are not frequently dealt with except by removal of the tooth. But the mere presence of a point of suppuration in the jaw without associated, definite symptoms, either in the blood stream or in the patient's general health, significant of chronic suppuration, should not call for removal of a single tooth. The modern policy of removing a large number of teeth in cases of, say, arthritis (inflammation of a joint) is not a wise one. Definite association between the disease and focus should first be demonstrated. A considerable percentage of arthritis cases fail to improve after general tooth extraction —in fact, often become aggravated. In cases open to this risk preliminary vaccine treatment is of the greatest advantage,* and where no urgent symptoms call for the immediate removal of the teeth, vaccine immunization (making the patient resistant) by appropriate vaccine to raise the patient's general resistance, greatly diminishes the risk of delayed secondary infection. On the other hand, acute or subacute infections often demand immediate surgical intervention, but whenever suppurative mouth infections must be dealt with by wholesale extraction, careful consideration should first be given to this point (of secondary focal infection) the question of progressive extraction raised and the rule followed that a bacterial examination should first be made. Before making a definite conclusion that the mouth is the source of infection all other possible sources should be eliminated

with which the patient's condition may be reproduced in animals, is a factor not thought of in the past. A focus (point) of infection wherever found, as in the intestinal or genito-urinary tracts, teeming with microorganisms (page 18) should be regarded as placed where bacteria and their products can be absorbed. Devitalization of teeth (killing the nerve) is a dangerous procedure. Suitable treatment has been devised. Prevention and cure of infected areas wherever located is a hygienic measure of the first importance.—*E. C. Rosenow, M.D., of the Mayo Foundation, Rochester, Minn., Journal A, Dental Assn., Oct. 1924.*

*The author refers preferably to autogenous vaccine (prepared from secretions within the patient's body).

such as chronic appendix, uterine infection, post-nasal suppuration[1] and intestinal putrefaction.

A large proportion of cases of stomach disturbance is due to infection from organisms of mouth origin and are easily recognizable. Gradual degeneration of the digestive function follows the persistence of lactic acid fermentation, followed by actual infection of the gastric wall. Infection of the blood stream direct, as suggested by Rosenau,[2] is probably the chief road by which bacteria set up diseases in other parts of the body. In such cases the air passages have presented symptoms of chronic lung affection leading to a diagnosis of tuberculosis and in a considerable percentage of cases the patient has been so treated.[2]

Rosenau[3] produced 84 per cent of disease in rabbits by the injection of the streptococci of endocarditis (inflammation of the lining membrane of the heart) and but 14 per cent in rabbits inoculated with strains from other sources.[4]

Inflammation of the joints for ordinary purposes can be divided into two classes, rheumatic arthritis and rheumatic gout (joint inflammation; chalky deposits and increase of uric acid in the blood). Many such cases are not chronic but acute, of which the following is an instance: The patient, a girl aged 24, suffering from chronic tooth suppuration, had two teeth removed. The next morning she had a chill with an evening temperature of 101°. Next day it was 100°, but both wrist joints were swollen and acutely painful for 48 hours. Some

[1] Goadby.

[2] In *Journal of Dental Research*, V. 1, No. 3, and *Jour. Immunology*, 1, 363.

[3] *Journal Infectious Diseases*, VI, 245.

[4] Streptococci as well as staphylococci (see class distinctions in chapter on bacteria) were seen long ago in the pus from inflammations, but their constant presence and significance were first strongly emphasized in the early 80's. Owing to the great variety of conditions of disease with which streptococci were found associated it has not yet been definitely settled whether there are several pathogenic races (different kinds connected with different diseases) or not. Cultures from erysipelas, for instance, were long kept in a class by themselves, but further investigation has tended to obliterate any sharp distinctions between this and the pus variety, and the different races cannot yet be regarded as definitely settled. (Jordan's "Bacteriology," 1922.)

weeks later two more teeth were extracted. The fever and wrist pains and swelling returned. Large numbers of streptococci were obtained from the jaw where the extraction wounds had not healed, and also from the urine. Subsequent vaccination from urine culture specimens resulted in the gradual disappearance of the joint symptoms, but after each of the four injections a rise of temperature with swelling and tenderness of the affected joints occurred. Poynton and Payne have demonstrated that many cases of acute rheumatism or rheumatic fever are due to streptococci infection.[1]

In another case, a male aged 47, who suffered from pus in tooth socket, had 7 teeth removed. Four months later he noticed stiffness of the left knee joint followed a few weeks later by stiffness in the right knee. Six months later, when advice was sought, considerable pain on movement was present. X-ray films showed bony excrescence in both knee joints and the beginning of disease of the ankle and wrist. An examination of the mouth showed no source of infection. The post-nasal spaces and tonsils gave streptococci of the sub-acid group. There is little doubt that the infection had remained latent in the tonsils and later became chronic.[1]

Tooth Pastes and Powders as a Cause of Bad Teeth

Head's investigation into the cause of decay of tooth enamel has attracted much attention. For instance, he found that 1 part lactic acid (produced in the fermentation of milk) to 1,000 parts of water at mouth temperature will cut enamel into a rough white surface in 30 minutes. A tooth placed in 1 part to 500 lactic acid and saliva will be unharmed. A 1 to 500 saliva and lactic acid solution has an extremely acid taste and instantly turns blue litmus brilliantly red. A 1 to 20,000 lactic acid and water solution will at the end of three or four days leave the appearance of a tooth intact, yet the outer

[1] Goadby.

surface of the enamel will, with the edge of a lancet, be found to have distinctly softened.[1]

The action of water solutions of acid calcium phosphate and acid sodium phosphate on the teeth has been mentioned by Kirk as causing smooth, white decalcification (injury to the enamel). As a matter of fact many acids in water solutions cause smooth primary softening if the solution is sufficiently weak. Two sound teeth with enamel impervious to the lancet were placed in the lobe of a navel orange. These lobes were each placed in a bottle, with a few drops of ether to prevent fermentation, at the body temperature for two days. It was found that the lobe around one of the teeth had fermented, the other had not. All the enamel of the fermented lobe was soft enough to be pared with a lancet. The enamel of the other tooth was also distinctly softened. These teeth were then washed and kept in saliva at body temperature for two weeks. At the end of five days there was a decided rehardening. In ten days the enamel could no longer be scratched. In two weeks the white area had almost disappeared and both teeth appeared normal. These experiments were verified.[1]

This softening and hardening of enamel has a very practical bearing on the use of dentifrices. Enamel that while hard will show but insignificant wear to dentifrice grit will show an appreciable loss under the same friction when softened. This softening and hardening may readily account for the reason why some patients, especially those fond of fruit, wear their teeth down to the gum at a comparatively early age. The mere friction of mastication is sufficient to take off a layer of enamel softened by fruit or vinegar which, if given the opportunity, will reharden.[1]

In the other article by the same author (previously set out) the results of numerous experiments with popular tooth powders and pastes are fully described. He says that tooth powders even of chalk are largely instru-

[1] Joseph Head, M.D., D.D.S., of Philadelphia. "Dentifrices and Their Ingredients," *Journal American Pharmaceutical Association*, December, 1912. Same author, "A Study of Saliva and Its Action on Tooth Enamel," *Journal American Medical Association*, Dec. 14, 1912.

mental in cutting the well-known smooth grooves in the necks of teeth that so frequently appear from the second molar forward. These tests were the beginning of a long series of experiments to determine just what would happen to the enamel and cementum (layer of bone over the root of the tooth) of teeth when brushed with certain mouth washes on the market and precipitated chalk.

It should be carefully noted that McCollum and Simmons, of Johns Hopkins, recommend soap as a good dentifrice and particularly point out that the *film on the teeth* against which certain manufacturers of dentifrices make a drive as being injurious is, in fact, Nature's protective covering of the teeth and should not be removed.[1] Even if this were not so persons with a nice hygienic sense might well hesitate before smearing over the teeth an animal product, such as pepsin, derived from the stomach of a lower animal, generally the pig, in order to "digest off" this protective film.

[1] See Chapter XXX.

NOTE TO SECOND EDITION.

Referring back to the statement of Osborn (page 278) in regard to crowns and bridges, the fact needs emphasizing that the science of dentistry has moved away from non-removable crowns and bridges in favor of inlay work and crown and bridge work that is removable whenever possible.

Chapter XXXVI

STARTING RIGHT WITH INFANTS AND CHILDREN

Fischer says that with many mothers and nurses the indiscriminate drugging of children to move the bowels is a daily routine.[1] This practice is so common that it is rare to hear of infants or children who function normally. Drugs and correctives are used without rhyme or reason.

The giving of a daily laxative will in time result in a great diminution of bowel movements that are produced by coarse food regularly fed. And the daily use of the warm soap-water enema should also be condemned. While the enema will produce an evacuation, the warm water relaxes the intestines and, if persisted in, will produce a lack of tone in the intestines with a tendency to prolapse, (fall). The proper temperature of such enemas is 60° to 70° and not more than a pint in quantity, usually half a pint at bedtime or about half an hour before the second morning feeding. The cold enema has a stimulating and tonic effect and does not produce any harmful result.[2]

The habit of adding correctives to the infant's milk daily should be condemned. When large masses of tough, rubbery curd pass through the intestine undigested, due to excess of protein feeding, boiling the milk will soften the curd and frequently modify the constipation. The condition caused by fat indigestion, known as a calcium-soap

[1] Louis Fischer, New York, in N. Y. *Medical Record*, 1919, p. 275, formerly lecturer on diseases of Children, New York Post-Graduate Hospital. Physician-in-chief to babies' wards, Suydenham Hospital. Author, Infant Feeding in Health and Disease, 1901; The Health Care of the Baby, nineteenth edition, 1922. Diseases of Infancy and Childhood, ninth edition (2 vols. 1922). Health Care of the Growing Child, 1915.

[2] Same. This is about 10 degrees cooler than recommended by Kellogg. Cold water should never be used in any form of colic or intestinal spasm. (See pages 184, 185).

stool, results from the formation of fatty acids in the stomach and intestines. In such cases the food must be modified and not calomel and purgatives administered. When the food agrees and there is neither colic nor vomiting, but a gain in weight, the better plan is to continue the formula and if constipation exists add an ounce of buttermilk whey to each feeding. This is made by boiling the buttermilk and straining out the curd. One dram (eighth of an ounce, a teaspoonful) of the malted foods (that can be bought, for instance, malted milk) or a dram of malt soup will modify the constipation.[1]

The importance of water is not sufficiently emphasized. Neither boiled or pasteurized water should be used but pure, filtered, cool water. Invariably when mothers are questioned they admit giving boiled water to their infants. Boiled water is right when traveling or when the purity of the water is in question. Fresh, cool water will aid in eliminating food residue when given between meals, which should be done several times a day. Water added to the food is not sufficient. If refused it can be rendered more palatable by the addition of fruit juices, such as orange, prune or pineapple. Prune juice and spinach juice should also be given for their vitamin content, their anti-scorbutic properties (scurvy, see chapter on Vitamins) and their laxative tendency. Diluents (diluted foods) such as oatmeal, barley water and other starchy gruels, while nutritious and valuable in modifying casein and fat of a given formula, have not been successful in modifying constipation. Their value consists in adding more protein to the food although flatulence and belching usually result.

In the older child the mechanical stimulus to the intestine can be given to food by the addition of bran to cereals or by the use of figs, raisins, whole wheat bread (not fresh) and the coarse cereals such as oatmeal.[2]

[1] Same.

[2] Mattieu Williams, an eminent English authority, in his *Chemistry of Cooking*, says oatmeal and starches generally should have a long cooking at a low temperature (140 to 165 F.) in order to prepare them for easy digestion. The oatmeal can simmer on the back of the stove for hours. For this reason he recommends well-done bread not baked at a quick temperature, but as low as possible, with well-browned crust.

Buttermilk or fermented milk can be used to thin the gruel. To sweeten the food, as well as for the food value granulated sugar or malted sugar (dextri-maltose) or malt soup[1] should be added to the milk. Vegetables such as chopped spinach or chopped string beans, and the green vegetables (rather than the starchy cereals such as potato) should be given. Crackers, wheat bread, biscuit, potato and macaroni are the foods which should rarely be fed unless mixed with a laxative diet. Deficient peristalsis can be stimulated also in older children by colon massage, gymnastics or calisthenics (house muscular exercise). In some instances gentle faradization (Faradic battery, alternating current) applied every other day will aid in stimulating internal functions and promoting peristalsis,[2] (bowel movement).

In subnormal nutrition where rachitic atony of the intestine exists (lack of strength and tone with symptoms of rickets—softening of the bones, malnutrition, enlargement of the liver and spleen, profuse sweating, great tenderness), there is no drug that will aid nutrition and modify constipation better than cod-liver oil. It must be given pure. To an infant six months of age 3 drops may be added to milk three times a day and the dose increased until 10 drops are given three times a day regardless of the season. It is an anti-scorbutic (useful in scurvy) in summer as well as winter.[3]

Oil injections can be utilized by means of a glass syringe with a rubber tip attached. One half ounce of oil[4] injected into the rectum or allowed to flow into the colon, will soften feces and in some instances promote nutrition. If left in the colon over night some of the oil will be absorbed. Oil injections should not be used oftener than every second night.

[1] To make malt soup:

cold water	25 parts
milk (4% fat)	13 parts
white flour	2 parts
Malt extract (Loefflund's)	4 parts

Mix flour and water and bring to a boil. Add malt, stirring constantly, and bring to a boil. Lastly add milk, stirring constantly. Bring to a boil 3 times, between times cooling it off quickly by standing in cold water.

[2] Same.

[3] Same.

[4] About 4 teaspoonsful.

The well-known results of thyroid therapy (utilization of the dried extract of the thyroid gland) in sporadic cretinism (imperfect mental and physical development) and the specific action of the thyroid on the constipation accompanying this disease, needs no emphasis. The administration of ¼ grain of thyroid[1] three times a day, gradually increased until 1 grain is given three times a day has acted beneficially in quite a number of cases. Pituitrin[2] is used for the same purpose. In obstinate cases 2 to 5 minims (drops) may be given hypodermically (under the skin by puncture) and repeated once in 24 hours. Some few cases respond. Interference with normal gland activity and forcing bowel movements continually for months and sometimes for years will lead to intestinal atony (weakness). We must distinguish between acute conditions with fever, in which there is lessened functional activity of the intestinal mucosa (mucus membrane) and the condition of deficient glandular secretion wherein medical assistance is required.

The same author says in his *Diseases of Infancy and Childhood* that casein (the chief protein constituent of milk and occurring nowhere else), can be fed to very sick infants and will be assimilated in either small or large doses. It stimulates alkaline secretion hence is antagonistic to acid fermentation. Casein is therefore indicated to combat diarrhea. This teaching based on experimental feeding reverses our former theories on the danger of giving large percentages of such protein. This form of food, recommended by Finkelstein, has gained a strong foothold in many clinics abroad. He has used it successfully in cases of intestinal disturbance, enteritis (associated with dyspepsia), atrophy associated with decomposition, and cholera infantum (summer complaint). Fever, if present, does not contra-indicate the use of this food. It has a low sugar and low salt content, and is prepared as follows:[3]

[1] Park Davis and Co. or any reliable producer.

[2] Trade name of an extract from the posterior lobe of the pituitary gland (generally of cattle) at the base of the brain and attached to the brain by a peduncle (stem).

[3] Formula of Jerome S. Leopold, M.D., of the department of Children's diseases, Post Graduate Hospital, New York.

Heat 1 quart of milk to 100° F. Add 4 teaspoonfuls of the essence of pepsin and stir. Let the mixture stand at about 100° F. until the curd has formed (about half an hour). Filter the whey from the curd through a linen cloth and discard the whey (a thin fluid). The curd is then removed from the cloth and pressed through a fine sieve by means of a paddle or spoon. Add 1 pint of water during this process. The fluid should now look like milk and the precipitate must be finely divided. To this mixture 1 pint of buttermilk is added. The composition is now

Protein (casein)	.3 per cent
Fats	2.5 per cent
Sugar	1.5 per cent
Food Salts	0.5 per cent
Water	95.2 per cent

Casein milk should be given in small quantities of 2 to 4 ounces in catarrhal diarrhea, 6 to 8 ounces in wasting, (atrophy), every 3 or 4 hours, depending on the age of the infant.[1]

Sugar should not be added until the stools are homogenous (uniform). Either malt or cane sugar can be used. This method of feeding should be continued for months, always used as a corrective for gastro-intestinal (stomach-intestinal) disturbance. It should be used as a substitute diet if the artificial diet in use disagrees or deranges the digestive tract.[2]

Hess [3] in making a comparison between cow's milk and human milk says that while cow's milk may be modified to approximate woman's milk in composition it can never be just the same or just as good for infants. Cow's milk is more opaque, due to the opacity (non-transparency) of the calcium-casein (lime-protein) which is present in

[1] In cases of summer intestinal troubles the late Dr. Abraham Jacobi said he often resorted to the enema (temperature 80°); and that whereas he frequently found the little patient feverish and fretful, tossing on its pillow, he left it in quiet slumber with beads of perspiration coming out.

[2] Fischer.

[3] Julius H. Hess, M.D., head of the Dept. of Pediatrics (Children's diseases), University of Illinois College of Medicine; Chief of Pediatrics, Cook County Hospital (Chicago); Attending physician for Children's Diseases to Cook County, Michael Reese and Englewood Hospitals; in *Principles and Practices of Infant Feeding*, F. A. Davis Co., Philadelphia.

greater proportion in cow's milk. The latter is faintly acid or amphoteric [1] when freshly drawn but ordinarily is distinctly acid in reaction when consumed. Human milk is amphoteric or alkaline. There is three times as much protein in cow's milk as in human milk. The reason for this is obvious when we recall that the ratio of growth of the calf to that of the infant is about 2 to 1. Furthermore the protein in cow's milk consists chiefly of casein (3.02%) and little lactalbumin (0.53%) while human milk is credited with 0.59% of casein and 1.23% of lactalbumen (albumin of milk). The sugar in the two milks varies greatly in amount but not in kind. Cow's milk contains almost four times the amount of inorganic salts as mother's milk. In the former, calcium and magnesium are in greater proportion, while in mother's milk potassium and sodium bases are in relatively greater amounts. These differences have an important bearing on the infant's nutrition. There is no great difference in the fat of the two milks but in both human and cow's milk the fat portion is a variable factor. The curd of cow's milk is usually the tougher while there are also differences in the antibodies (antagonistic to disease germs), ferments, etc. Cow's milk is never sterile (free from germs), while human milk is practically so.

Hess further says that constipation is frequently associated with colic and flatulence, disappearing with a proper diet. It may be due to too much milk at proper intervals, too frequent feedings, too much fat, excess in sugars and starches. Excessive flatulence can frequently be eliminated by reduction or change in the kind of sugar[2] and cereal gruels. Feeding powdered casein in amounts varying from 4 to 8 grams (about ⅛ to ¼ of an ounce) dissolved in 30 to 60 mils [3] of water two or three times a

[1] Having two opposite characteristics such as freshly drawn milk which turns blue litmus paper red (the sign of acidity) and red litmus paper blue (the sign of alkalinity).

[2] Louis Fischer says in *The Health-Care of the Baby:* There are three kinds of sugars used in infant feeding: milk sugar (lactose); cane sugar (sucrose), ordinary table sugar; malt sugar (maltose). When constipation exists milk sugar or malt sugar should be used. Infants gain in weight on malt sugar preparation such as Mead's Dextri-Maltose No. 1 (salted) or No. 2 (unsalted).

[3] Mils—milliliters, 1–1000 of a liter, about 15 drops in the case of water, about ¼th of a standard-sized teaspoonful per mil, or a little less.

day will relieve colic in many infants in all probability due to lessening of peristalsis (movements of intestine). The constant solicitude over gas on the stomach is unwarranted. All bottle-fed babies have gas on the stomach. They swallow the air in feeding (as many adults do). If the baby is raised to a sitting position the gas will usually come up.[1]

In breast-fed babies and not infrequently in infants fed on boiled milk, the colon is often sluggish. One or two ounces of a saline enema[2] or sweet oil injection can be recommended. If properly used they are not harmful, nor do they create bad habits which are often ascribed to them. A regular hour for their use, with proper training, creates regular habits and in most instances the condition improves to such an extent that they can be discontinued. Most infants can be trained to regular habits by the fourth or fifth month. In the presence of fat-soap stool it may be necessary to substitute skimmed milk temporarily with increase of sugar. In the presence of constipation where the maltose-dextrin compounds have been used, a change to milk sugar or cane sugar, or one of the dextrin-maltose compounds (see subsequent footnote) containing a high percentage of maltose and potassium carbonate, is often beneficial. Occasionally the addition of cereal water to the diet is of benefit. The reverse, however, may be the case. When the infant is old enough constipation is best relieved by the addition of vegetables, fruits or fruit purees (pressed through a sieve). When the above fail the addition of 1 or 2 teaspoonfuls of milk of magnesia to the day's feeding answers well for temporary use or 1 or 2 tablespoonfuls of dry or liquid malt soup extract added to the day's dietary, acts equally well. In infants where constipation is distressing and other dietetic changes fail, a week or two on Keller's malt soup usually works wonders. Underfed infants frequently suffer from constipation. Such stools are small, dark in color and contain much mucus and are associated with stationary weight. Increase in the bulk of the diet

[1] Hess.

[2] Teaspoon of salt to a pint of boiled water. (Dr. Walter Reeves Ramsey).

relieves the constipation. Where there is a predisposition against milk, which causes vomiting and diarrhea, the symptoms speedily subside upon the use of castor oil. This class of cases offers great difficulty in feeding during the first year as carbohydrates (sugar and starches) must of necessity form a considerable portion of the diet. Broths, cooked cereals and vegetable purees should be gradually added to the diet as soon as they can be digested.[1]

A diet for the child artificially fed recommended by Hess, and endorsed by Fischer, is as follows:

AT BIRTH.

Certified or Grade A milk[2]	2 ounces
Barley water[3]	16 ounces
Dextri-maltose (see later footnote)	3 teaspoons

Heat milk and barley water to steaming point, steam 20 minutes, add the maltose and divide into 8 feedings of 2½ ounces each. Gradually increase to diet for

[1] Hess.

[2] If other or canned milk is used heat the milk to the boiling point then add the maltose and cool rapidly.

[3] *Barley Water.*—Add 1 tablespoon of pearl barley to 1 quart of cold water, boil 2 hours, adding water from time to time. Strain through muslin and add enough boiled water to make 1 quart. If barley flour is used mix 2 teaspoons of flour in a little cold water, add 1 quart of water and boil 15 minutes. If there are any lumps strain through muslin and add boiled water to make 1 quart.

ADDITIONAL FORMULAS

Rice Water.—Made in the same manner as barley water. 1 teaspoonful of rice to 1 quart of water. If rice flour is used 2 teaspoonfuls to 1 quart water.

Oatmeal Water.—Same method. 1½ teaspoons of oatmeal to 1 quart of water.

Gruel.—2 teaspoons of rice flour, barley flour or oatmeal to 1 pint cold water. Boil briskly for half an hour, add a pinch of salt and teaspoonful of granulated sugar.

Albumin Water.—The white of 1 raw, fresh egg to be shaken in ½ pint of water. Feed through nipple or by spoon.

Nutritious Lemonade.—Juice of half a lemon, yolk of a raw fresh egg, let stand 5 minutes, use of this 2 teaspoons. The above formulae from Diseases of Infancy and Childhood (Fischer).

TEN DAYS.

Same milk ..... 4 ounces
Barley water ..... 16 ounces
Dextri-maltose[1] ..... 4 teaspoons

Divide into 8 bottles of 2½ ounces each. Feed every three hours. Gradually increase to

ONE MONTH.

Same milk ..... 7 ounces
Barley water ..... 20 ounces
Dextri-maltose ..... 5 teaspoons

Divide into 7 bottles of 4 ounces each. Feed every 3 hours.

If the above disagrees and there is vomiting, colic or curded and slimy stools, give a teaspoonful of castor oil and try the following:

Evaporated milk, Peerless brand[2] ... 2 level teaspoons
Hot water ..... 6 ounces
Granulated sugar ..... 2 level teaspoons

Divide into 2 bottles, feed every 3 hours, use 3 days. If improved return to cow's milk formula.

TWO MONTHS.

Same milk ..... 11 ounces
(Increase 1 ounce weekly until 13 ounces are given)
Barley water ..... 19 ounces
Dextri-maltose No. 1 ..... 6 teaspoons
(Use No. 3 if constipated)

Divide into 6 bottles each. Feed every three hours.

THREE MONTHS.

Same milk ..... 14 ounces
(Increase weekly to 16 ounces)
Barley water ..... 16 ounces
Dextri-maltose No. 1 or 3 ..... 9 teaspoons

Divide into 6 bottles of 5½ ounces each.

Feeding schedule: 6 a.m. bottle; 8 a.m. ½ ounce orange juice; 9 a.m. bottle; noon, bottle; 3 p.m. one ounce

[1] Mead's Dextri-Maltose No. 1. Dextrine is a soluble carbohydrate into which starch is converted by diastase, which in turn is a ferment found in malt, which converts starch into glucose found in grape sugar and many fruits. This is the digestive process for starches (see Prof. Mattien Williams, next page).

[2] Another excellent brand is the Helvetia, made by the Swiss Method, in Helvetia, Illinois.

spinach, celery or carrot juice, bottle; 6 p.m. bottle; 10 p.m. bottle. Gradually increase to

FOUR MONTHS.

Same milk	15 ounces
Barley water	14 ounces
Dextri-maltose	9 teaspoons

Divide into 5 bottles of 6 ounces each. Feed every 4 hours.

Feeding schedule: May have 2 teaspoons of fruit juice at 9 a.m. and 2 teaspoons of vegetable juice at 5 p.m. At five months may increase fruit and vegetable juice to 3 teaspoons. Gradually increase to

SIX MONTHS.

Same milk	26 ounces
Boiled water	12 ounces
Dextri-maltose	12 teaspoons

Divide into 5 bottles of 7½ ounces each. Feed every 4 hours.

Feeding schedule: 6 a.m. bottle; 9, four teaspoons of fruit juice; 10, bottle; 2 p.m., bottle and 2 rounded teaspoons of crushed zweiback[1]; 5, four teaspoons vegetable pulp; 6, bottle; 10, bottle.

At seven months. May have 5 teaspoons of fruit juice in addition at 9 a.m.; 5 teaspoons of vegetable pulp at 5 p.m.; 2 rounded teaspoons of crushed zweiback at 2 p.m. With the 6 p.m. bottle may have 6 level teaspoons of boiled farina or arrowroot pudding. Gradually increase to

NINE MONTHS.

Same milk	32 ounces
Boiled water	4 ounces
Dextri-maltose	12 teaspoons

Divide into 4 bottles of 9 ounces each. Feed every 4 hours.

Feeding schedule: May now have 6 teaspoons of fruit juice at 9 a.m.; 4 teaspoons of crushed zweiback at 2 p.m. 6 teaspoons of vegetable pulp at 5 p.m. and 6 teaspoons of farina or arrowroot with the 6 p.m. bottle.

[1] Zwieback means twice baked, but frequently, unfortunately, is sweetened. It is sold in packages. If not available, white bread should be thoroughly baked at a slow temperature so as to lightly brown it, allowed to cool off, then re-baked. The idea is to dextrinize the starch. (See page 230). *The stomach is thus helped in the digestion of starch.*

At one year may have 1 ounce of fruit juice at 9 a.m., the yolk of a hard-cooked egg[1] at 10 a.m., 4 teaspoons of crushed zweiback at 2 p.m. and at 6 p.m. 8 teaspoons of farina or arrowroot.

12 TO 18 MONTHS.

Use fresh raw milk warmed to feeding temperature.

6 a.m., milk 8 ounces, Hunt and Palmer biscuit; 8.30 a.m., juice of an orange or 1 ounce pineapple juice; 9.30 a.m., saucer of steamed oatmeal, farina, hominy, cream of wheat, yellow cornmeal or wheatena, served with milk or thin cream. One piece zwieback, rusk or toast with butter, milk 6 ounces. 12.30 p.m., half ounce steak or roast beef juice, baked potato with yolk of hard cooked egg and stewed prune pulp; or chicken and chopped noodle soup, rice with yolk of egg and stewed peaches; or beef and farina or carrot soup, spinach with yolk of hard-cooked egg and stewed apricots or apple sauce. (On very warm days cold consomme can be used instead of warm soup). 3.30 p.m., milk, 8 ounces; 6 p.m., saucer of arrow-root or cornstarch pudding, junket or cream cheese or biscuit. 10 to 11 p.m., if awake and restless, milk 8 ounces.

(To make a hard-cooked egg yolk, place the egg in a pan and cover with boiling water. Do not allow the water to boil thereafter but keep it hot for 45 minutes. The yolk then will be formed but mealy.—Kellogg.)

18 TO 30 MONTHS.

6 to 7 a.m., milk 8 ounces, two pieces of zwieback rusk or Huntley and Palmer's biscuits. 8 a.m., juice of an orange. 9 a.m., steamed farina, oatmeal hominy or cream of wheat, with chopped dates or figs, raw or stewed; a coddled[1] or poached egg or arrowroot pudding. Crisp toast buttered. Milk 6 ounces. 12.30 p.m., beef or chicken broth (canned soup if necessary, such as Franco-American), thickened with sago, rice or farina, clear broth with yolk of egg, or 1 ounce of steak or roast beef

[1] Contrary to the prevailing opinion about hard-boiled eggs Kellogg says in New Dietetics, "Hard-boiled yolks cooked until they are mealy are easily digestible, which is not true of the whites."

[2] *Coddled Egg.*—Boiling water poured on the fresh egg and allowed to stand eight to ten minutes, until the contents are jellied.

juice. Baked potato, spinach, carrots, peas, string beans, beets, asparagus tips or celery (all stewed). Fresh vegetables, to be used whenever possible. Stewed prunes, stewed figs, baked apples or apple sauce. Huntley and Palmer biscuits, graham wafers or lady fingers. 3.30 p.m., milk 8 ounces, Wheatworth cracker. 6.30 p.m., soft-cooked egg, junket[1], custard, cornstarch, tapioca or farina pudding, or cream cheese on biscuit. Half of a sliced banana or raw scraped apple. Cup of milk or weak cocoa.

3 TO 6 YEARS.

Breakfast.—Orange, apple sauce, prunes or figs. Saucer of farina, cream of wheat, pettijohn, yellow cornmeal, oatmeal, hominy or wheatena (all cereals to be steamed in water at least 2 hours. Served with cream and sugar). If appetite warrants it, a coddled egg. Roll, toast or corn muffin. If constipated, bran muffin. Cup of milk or cocoa.

Dinner.—Chicken, lamb, beef or vegetable soup. Expressed steak-juice, calf's foot or chicken jelly, raw scraped steak, minced chicken or fish. Spinach, peas, beans, young carrots, beets, asparagus, cauliflower, baked or creamed potato, stewed apples, peaches, apricots, prunes or berries. Sponge cake or lady fingers.

Supper.—Two poached or scrambled eggs or ham or jelly omelet; custard, junket, cornstarch or tapioca pudding; cream cheese, bread and butter; sliced banana with milk or raw fresh fruit. Cup of milk, malted milk or cocoa.[2]

[1] *Junket of Milk and Egg.*—Beat 1 egg to a froth and sweeten with 2 teaspoons of white sugar. Add to ½ pint of warm milk. Add 1 teaspoonful of essence of pepsin (Fairchild). Let stand until it is curdled. Useful in typhoid and similar wasting diseases.

To Make Junket.—Add 1 teaspoonful of liquid renin to 1 pint of milk. Mix and heat until steam rises. Pour into cups and set aside to cool. Flavor with vanilla if desired. Or to a bowl containing 8 ounces of cool milk add 1 teaspoonful pepsenicia, (see next page). (Fairchild). Mix thoroughly. Place bowl in pan of boiling hot water two minutes. Remove and allow to jelly.

[2] According to Chittenden this diet seems too rich in protein—meat and eggs even for growing children. Reference is made to the 3 whole eggs allowed for the day, with the addition of meat soup, scraped steak, minced chicken or fish, custard (with more egg) and cream cheese. Turn back and read of the dietary on which Chittenden's squad of soldiers and athletes thrived (page 85). Also compare with the simple dietary recommended by McCollum, based on scientific experiments with animals later in this chapter. We think Chittenden and McCollum have proved their case. Kellogg recommends stale well-baked bread (or zwieback) and milk for a child's evening meal.

McCollum [1] says that at a meeting of baby specialists in 1917 the subject of feeding green vegetables was thoroughly discussed. The use of steamed spinach that has been rubbed through a sieve was strongly approved. It should be begun at the age of six months to the extent of a tablespoonful a day with double this amount at nine or ten months up to three spoonfuls after the child is a year old. Orange juice should be continued with the spinach. The practice of feeding infants sweet evaporated milk has grown enormously and has done much damage. Canned milks are not fit food for infants and should be used only in emergencies. The bones do not develop normally on this food and physical weakness and low vitality in later life is almost sure to result. The first choice of substitutes for mother's milk is the milk of the goat which does not suffer from tuberculosis. Then comes raw cow's milk from a healthy, clean source. Otherwise it must be pasteurized, which is not a satisfactory treatment if it can be avoided. When a goat is kept for an infant doubtless the best method is to apply child directly to the nipple. It will thus get its milk free from bacteria. The nipple should be carefully washed several times with water that has been boiled. If this method is not followed the goat should be milked immediately before each feeding.

After the weaning, which should take place at about one year, about three tablespoonfuls of spinach should be given daily in addition to the milk. One or two tablespoonfuls of cereal thoroughly-cooked at a moderate temperature, slightly salted, should be added to the milk when spinach is not fed. Baby should be given a piece of crisp toast or zweiback to chew once a day. *Milk should remain the principal dependence and orange juice given regularly.* An egg yolk may be given every other day instead of the spinach or cereal. Do not give baby meat, tea or coffee or sweet foods. After two years baby can be given more cereal but the diet should consist largely of milk, egg yolk, green vegetables, toast and

[1] Professor of Chemical Hygiene in the School of Hygiene and Public Health, Johns Hopkins, Baltimore. We quote from his American Home Diet (in collaboration with Miss Simonds, instructor in Chemical Hygiene), Detroit, Frederick C. Matthews Co., 1920.

orange juice or a little ripe banana and scraped ripe apple. Tomato juice free from seeds is perfectly safe during the second year and thereafter if given in small amounts. Berries should not be used nor fruit that is unripe or unsound.[1]

During later childhood children should have about a quart of milk a day. They may eat freely of the simpler dishes provided for adult members of the family but the consumption of meat should be kept down to a very low limit. It is not necessary to deny them an occasional sweet dessert and they may well be given candy or sugar but always in small amounts with a meal rather than after it. They should be trained to like all green vegetables and a daily serving of carrots, turnips and other products of the garden is advisable. Fruit is better between meals than starchy or sweet foods. It leaves the teeth freer from adhering matter that promotes decay. [2]

The main principle to be kept in mind in the feeding of growing children is that they should not be allowed to form the habit of deriving too large a part of their diet from meat, bread, potatoes, sugar and breakfast cereals. Constant use of plenty of milk of good quality, supplemented by bread, potatoes,[3] cereals, fruits and abundant leafy vegetables, which are richest in vitamins, fulfil these requirements. Hard foods like dry zwieback serve to develop the teeth.

Of 10,500 school children in England and Scotland 86% had decayed teeth. Among 19,725 in Northern Germany this percentage was 96. In a group of 3,236 in Philadelphia between the ages of 7 and 14 the number of decayed teeth were 7,763. In Seattle the history of over 1,100 children showed the following percentages of decay.[2]

Nursed at least 6 months	42.6 per cent
Less than 6 months	42.9 per cent
Raised on sweetened condensed milk	72.1 per cent

Similar results have been obtained in other cities.[2]

[1] McCollum and Simonds.

[2] Same.

[3] Before baking a potato give it a scrubbing with a stiff brush. Then the skin can be eaten.

It is not a good plan to close a meal with a sticky carbohydrate but to eat an apple or other fibrous food, cold slaw or salad, since they tend not only to clean the teeth but exert a detergent (purifying, cleansing) action on dental caries (decay). Acid fruits are doubtless best for this purpose as they stimulate a strongly alkaline saliva, *which protects the teeth with a natural protective film.* Some manufacturers of dental creams advertise widely that this should be "digested" or scrubbed off. *Don't do it.* Use dental floss between the teeth and brush them after each meal with high-grade soap and water. The last saliva secreted will then cover the teeth free from residues with a film and thus preserve them.[1]

[1] **The American Home Diet. (Previously cited.)**

FINAL WORD TO READERS

Those who have read this book thus far with care are now fully aware of the motives behind its publication—giving wide publicity to useful information that will add to the comfort, happiness, health and longer life of each individual who reads it.

The imperfections the authors hope to correct as far as possible in future editions—such is the vanity of human wishes—and also to incorporate divers useful notes and additions suggested by readers.

Whether the work has been well done or not, it has been conscientiously done with a sincere desire to be of service, and to lift the subject out of the ruck of commonplace theory and opinion by going to the masters who really possess both knowledge and experience but have not had the opportunity, and possibly the art, of giving popular expression to a complex subject.

As the authors look at it, the reader also has opportunity for service if the book can be commended, and that is to speak a good word for it and pass it along, so that its distribution and influence may be greatly extended.

NOTE BY THE PUBLISHERS

The number of requests from appreciative readers of "The Lazy Colon" for information concerning the authors warrants a short statement.

The research work and preparation of the text was done by Charles M. Campbell, who has had a long and successful experience in this field. For over twenty years he has made a critical study of the relation of intestinal stasis to disease. That he is particularly competent for the exacting task undertaken in this instance the reader has probably already discovered.

Albert K. Detwiller, Ph.B. (Lafayette); M.D. (College of Physicians and Surgeons, Columbia University, New York); Fellow of the American Medical Association; Fellow of the Medical Society of the State of New York; and Fellow of the New York Academy of Medicine, was selected by Mr. Campbell as editorial associate because of his peculiar fitness as a practicing physician in the field covered by this book. For ten years he was chief of the large medical staff of a New York institution engaged in making periodical examinations of individuals and employees in large industrial groups, resigning in 1923. He has also been house surgeon of the New York City Hospital, assistant pathologist of the City Hospital and Russell Sage Institute of Pathology (where he performed thousands of autopsies), and is Pathologist of the French Hospital of New York. During the war Dr. Detwiller was Lt. Colonel in the Medical Corps and for fifteen months had the unique distinction of not losing a man by disease of the 1785 men of the command.

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